POPULAR SCIENCE Monthly

May 1949

25¢

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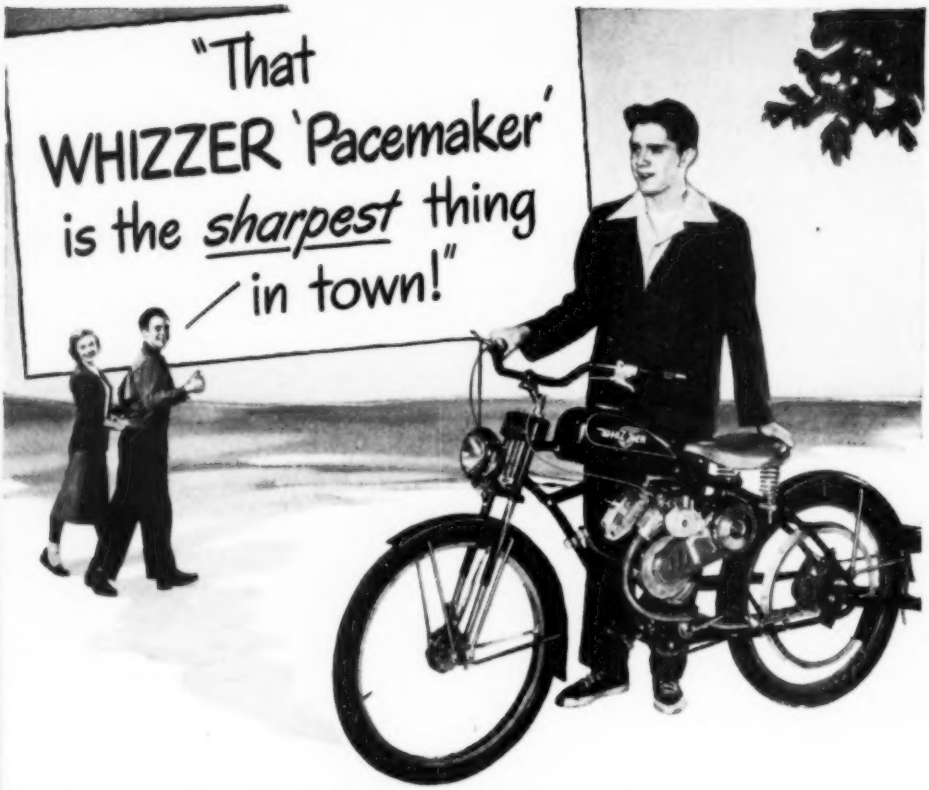
PAGE 106



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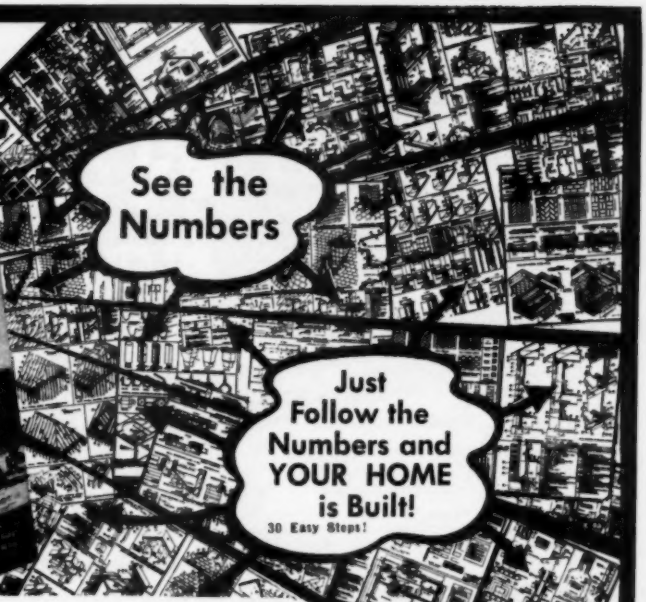

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POPULAR SCIENCE

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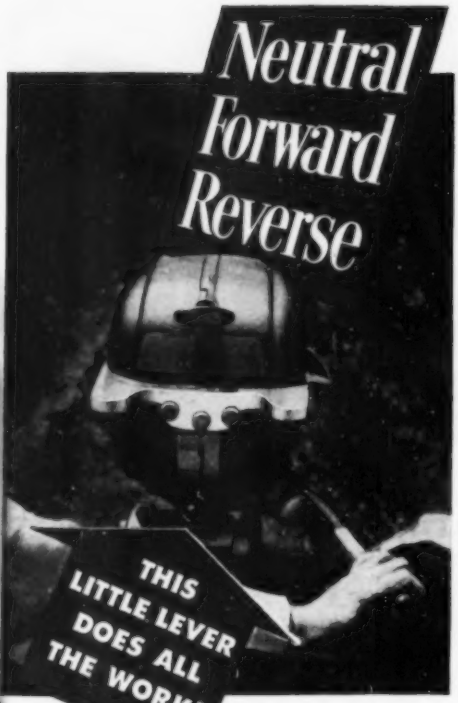

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C. I. Iams

Canton, Ohio

Reader Iams is one of 39 readers who have brought this slip to our attention—which shows that PS readers know their tractors. A TD-24, which does weigh nearly 18 tons, did go up the ramp, but unfortunately the only available picture of the ramp in use showed the much smaller TD-6, and the error was not caught in time.

Jeep Turns Corners

Sir:

On page 124 of the Feb. issue of Popular Science you had an article about a jeep that carries its own road along with it. This idea looks like it ought to work swell. But what happens when the jeep wants to turn a corner?

Dale Wilson

Sterling, Kansas

The jeep can not only turn, reports the Marine Corps, but with an experienced driver can be handled easily even in city streets, although its turning radius is about 75 feet. Its steering gear is connected to a rod on the front bumper that shifts the mat to the left or right as the wheels are turned. In addition, the mat's flexibility permits it to bend slightly in the direction of the turn.

Rubber Nozzle Stops Static

Sir:

I note with considerable interest the article on the "Gas Nozzle Made of Rubber" on page 169 of your November issue.

It occurs to me that it has always been considered necessary to have a metal nozzle,

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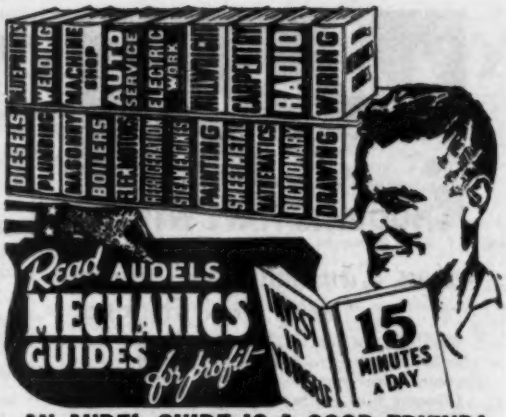

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and to make certain it is in contact with the car's inlet pipe before gasoline flows to prevent any static discharge from striking between the gasoline in the hose and the car's inlet pipe.

What's happened, Mr. Editor? Has theory been changed, or is static electricity behaving differently these days?

E. S. READ

General Electric Co.
Syracuse, N. Y.

Last seen, static electricity was behaving about the same as always, but the new B. F. Goodrich rubber nozzle has a special type of carbon black mixed into the compound that gives the rubber a high degree of electrical conductivity. Thus, by equalizing any differences in the static-electrical potential between the hose and the car's inlet pipe, the rubber nozzle prevents sparks from jumping between the two in the same way that the metal nozzle does.

A Few Kind Words

Sir:

Each month I read with interest the Letters to the Editor as they appear and the unusual way in which they are answered. As long as I have been reading this helpful publication, I cannot ever remember reading a letter of praise for the information which you present each month. Instead of commending the good work which your staff provides, most people seem to be contented to merely criticize the relatively few mistakes which are made. After all, it is only human to make a small mistake occasionally.

I personally wish to thank you and your capable staff for providing numberless hours of helpful and interesting reading matter which is quite apropos in this scientific age.

FRANK S. GRIBBLE

Mars Hill, N. C.

PS appreciates the many letters of praise it regularly receives, but feels that the "Letters" column should mostly be devoted to answering as many of its readers' questions as possible. Since space is short, the letters of praise, as much as we love 'em, often get crowded out.

Flap Keeps PS Fresh

Sir:

Here's a neat trick I learned to keep my

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ROBERT O. PETRIE

Oswego, N. Y.

Doubting Thomas

Sir:

Re "What the Cleaner Does to Your Suit," PS March '49—somehow I feel they don't do all this to *my* suit.

THOMAS PINCH

Washington, D. C.

Sports-Car Speedster

Sir:

I was very pleased to see some pictures of sports cars in the March edition of your magazine [p. 186], and I hope you will continue to publish descriptions of sports cars and their achievements.

There is one point I would like verified, however. You say that the B.M.W. averaged 104 m.p.h. in the 1940 Mille Miglia. This speed seems to me to be about 20% on the high side, taking into consideration that, on some sections of the road, to maintain an average of over 50 m.p.h. takes a lot of driving. (Twice crossing the mountains). If my memory serves me right in 1934 the winning speed was just under 71 m.p.h.

S. CHLUSEWICZ

Hamilton, Ontario, Canada

In a paper delivered before the Society of Automotive Engineers at French Lick, Ind., in June, 1947, Laurence Pomeroy, technical editor of "The Motor" in London, said that the B.M.W. "has a maximum speed in excess of 120 m.p.h." and that it had traveled "1,000 miles on an Italian road circuit at an average speed of 104 m.p.h." This race was the 1940 Mille Miglia to which PS referred.

Battle of the Train Light

Sir:

Were I a railroad engineer, I would hate to rely on the train light shown on p. 122 of the February issue of POPULAR SCIENCE.

Since railroad curves are banked to

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Pay Jumped $2000 A Year Since NRI Course

"Am Chief Engineer of WDOD. Before that was wireless operator on ship. Salary increased $2,000 a year since entering Radio."—JULIUS C. VESSELS, Chattanooga, Tenn.

Earns Cash in Spare Time to Pay for Course

"Earned enough spare time cash to pay for my course by time I graduated. N.R.I. training is tops!"—ALEXANDER KISH, Carteret, N. J.

Becomes Operator at Police Radio Station WASP

"When I enrolled, had no idea of entering commercial Radio. Am now Operator, Police Radio Stations WASP and WESJ."—GORDON [illegible]US, Selma[illegible]

Has His Own Spare Time Radio Business

"Work only spare time at Radio and average about $50 a month. Knew nothing about Radio before enrolling. Recommend N.R.I. to anyone."—SAMUEL T. DeWALD, St. Clair, Pa.

Gets Job with Radio-Television Manufacturer

"Most profitable investment I ever made. Went to work for Philco in their Radio laboratory. Constructed, maintained sets."—SAUL [illegible]

Now Boss of Own Money-Making Radio Shop

"Now have two Radio Shops servicing about 200 sets a month. Have largest Radio Sa[illegible]

Specializes in Marine Radio Installations

"Have been in several branches of Radio since [illegible] N.R.I. course [illegible]. Now specializes in Marine Radio [illegible] MURRAY [illegible]ucah, Ky.

didn't [illegible] from a [illegible] complete [illegible] and 3 ye[illegible] a store. WORTH[illegible]

[illegible] FCC [illegible]nse and [illegible]as Broadcast Engineer [illegible]ore complaining [illegible]cense as [illegible] operator [illegible] WMPC. [illegible] Engineer of station."—HOLLIS F. HAYES, Lapeer, Mich.

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neutralize centrifugal force acting on a train, each curve is banked for a designated speed. The only time the light would work as designed would be when the train is traveling slower than the designated speed of the curve it is on. When the train is traveling at the designated speed, the pendulum would remain in the same position with respect to the train, and the light would point straight ahead, as any fixed light would do. At speeds above the designated speed, the pendulum would be pulled outward and the light would actually point farther away from the track. A study of the vector forces acting on the pendulum should show you that this is true.

DAVID PESZNECKER

Seattle, Wash.

Mr. William Le Clair, inventor of the locomotive headlight, answers Mr. Pesznecker in the letter that follows:

Sir:

. . . I'll try to make clear how it is possible for the pendulum to turn a headlight on a locomotive negotiating a curve. The center of gravity of the locomotive moving forward is at the wheel base. If the gravity center were above the locomotive, there would be no need of banking road beds on curves. Now there is a dividing line between where centrifugal force begins and where gravity leaves off. Were a 1-pound weight supported six inches below the center of gravity, it would remain perpendicular to its axis up to a given speed, but if that given speed were exceeded, the arm supporting the weight would have to be lengthened to maintain the weight in a vertical position. I think the above covers the question.

WILLIAM LE CLAIR

Martinsdale, Mont.

After checking with several physicists, PS is forced to give the nod to Mr. Pesznecker —and a number of other readers—who correctly point out that the pendulum would be subject to the same centrifugal force as the train. At slow speeds, the pendulum would remain close to vertical, but at the speed for which the curve was banked it would swing outward and thus fail to turn the headlight. If the pendulum didn't swing outward on a curve, neither would anything else, and there'd be no need to bank the track. PS was so interested in the idea that this point was overlooked.

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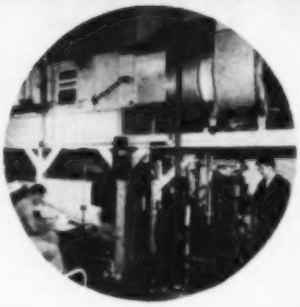

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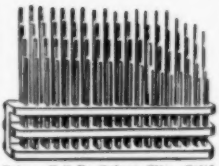

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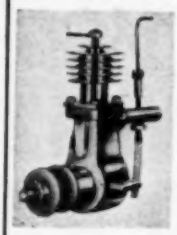

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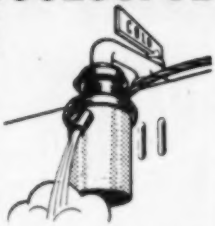

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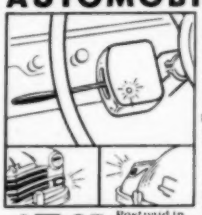

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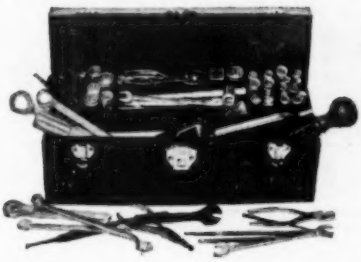

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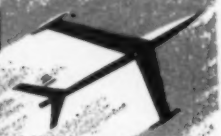

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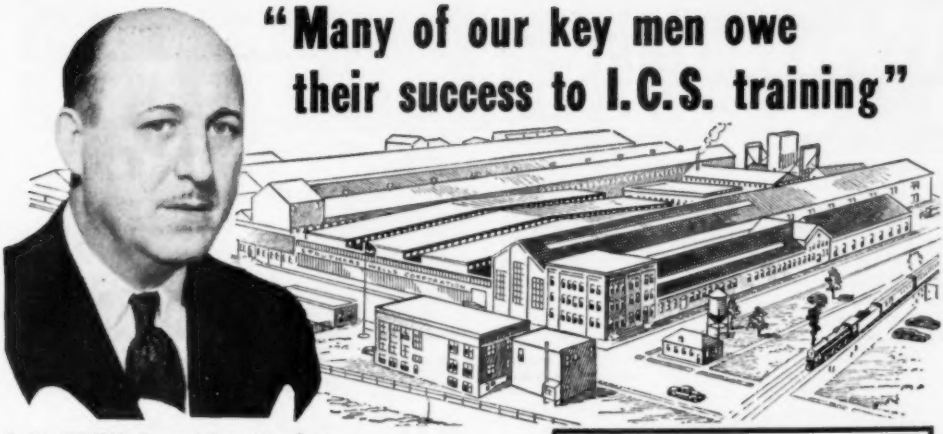

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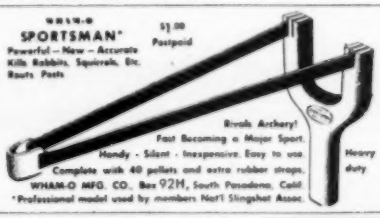

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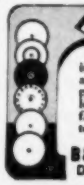

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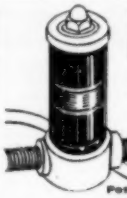

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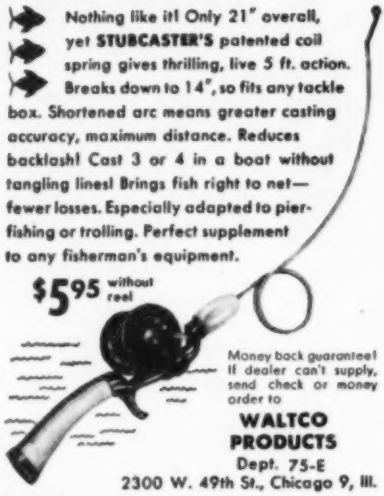

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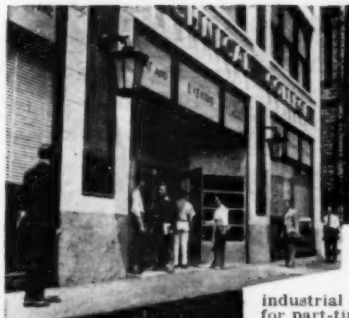

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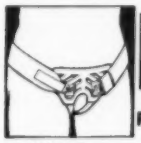

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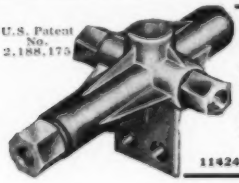

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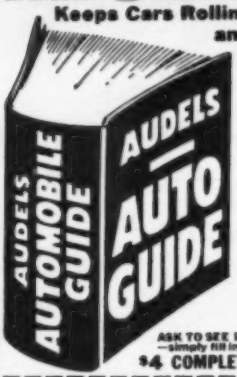

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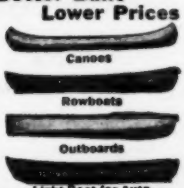

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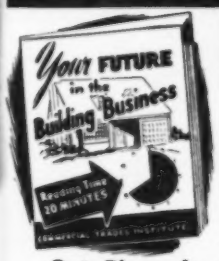

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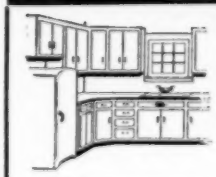

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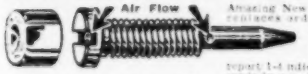

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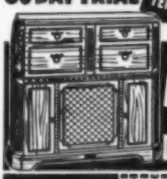

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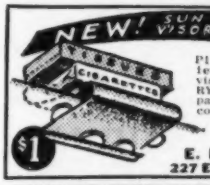

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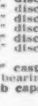

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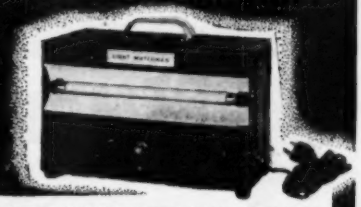

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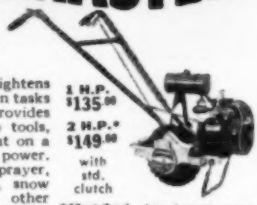

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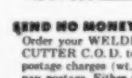

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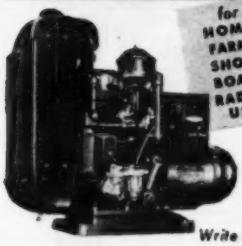

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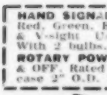

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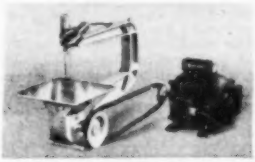

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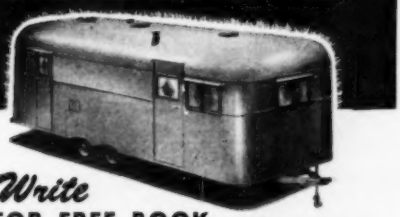

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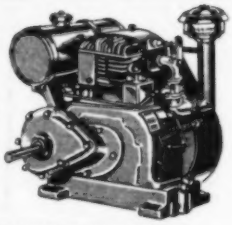

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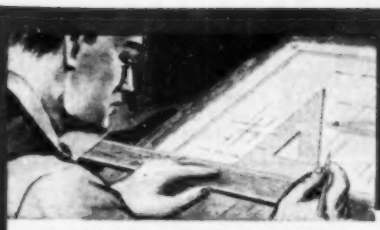

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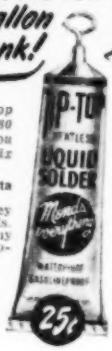

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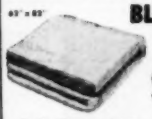

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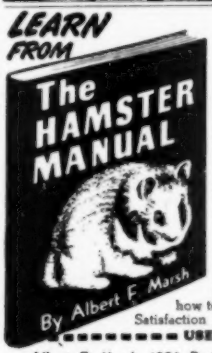

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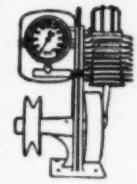

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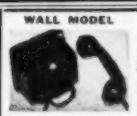

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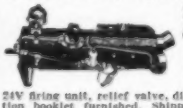

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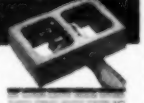

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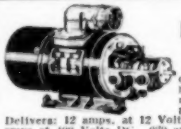

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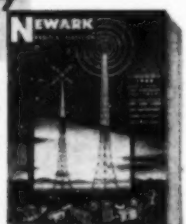

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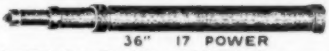

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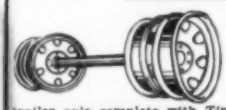

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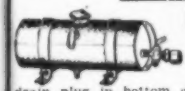

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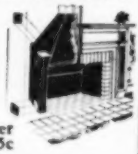

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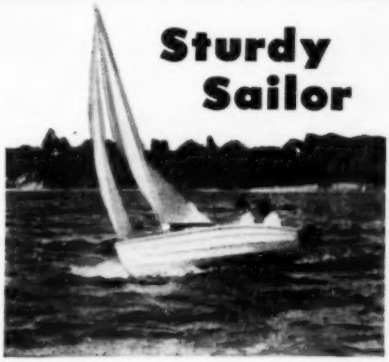

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7.2 H.P.
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Sharpens All Reel Type Mowers • Hand, Power or Gang • 10 to 20 Minutes • No Dismantling No Extra Attachments Needed

All reel type mowers, from 5-inch edgers to 36-inch power mowers, are quickly sharpened to extreme ends of both left and right twist reel blades. Handle, wheels, roller and motor remain in place when sharpening is in process. Bed knife is sharpened in same brackets that hold mower in grinding position. No extra attachments required. One lever puts mower or bed knife in grinding position. 100% steel construction. Grinding head rides on five ball bearing races. Easy to operate. Sharpens wood chisels, joiner knives and planer blades without extra attachments.

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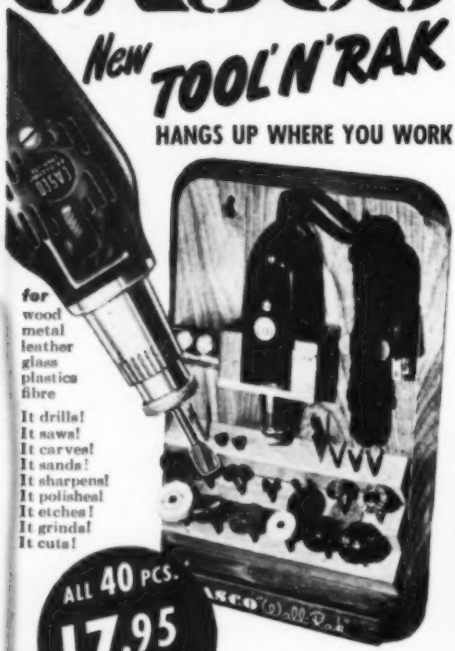

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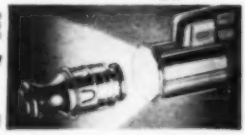
VIS-O-LITE

Casco's amazing new car lighter!

Eliminates fumbling in the dark!
Helps keep your eyes on the road!



Press it in—VIS-O-LITE pops out *automatically* when ready! While you're lighting your cigarette, the lighter well glows softly on your dashboard. Guides your hand surely back. Easy to install . . . **$2.75** complete.

Note: You can bring your present Casco lighter up to date with the illuminated well alone . . . for only **$1.50**

RENEW YOUR OLD CAR LIGHTER only $1

Heating element worn out? Just screw-on another Casco unit . . **$1.00**

Lighter unit lost? Replace it with a complete new Casco Pop-out unit . . . **$1.50**

(9 out of 10 car lighters are Casco-made. Insist on genuine Casco Replacement parts!)

Now featured at Car Dealers, Auto Supply Stores, Garages, and Gasoline Service Stations!

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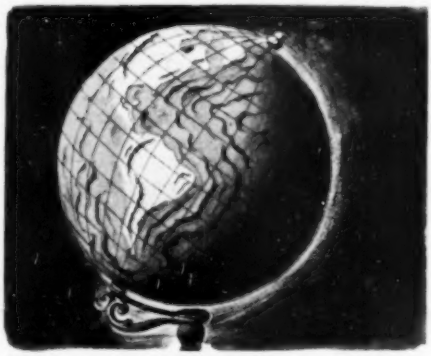
I'd like to see them make . . .

Everybody has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.



Globes with mountains and oceans shown in relief. The scale would have to be exaggerated. Maybe the globes could be molded of plastic, with land and sea in different colors.—*James Froberg, Palma Sola, Fla.*

Coal bins with slanted floors. If bins were built with about three-quarters of the floor higher at the rear than at the front, even the last half ton would be easy to reach.—*James A. Brady, Jr., North Attica, O.*

HIGH SCHOOL GRADUATES:

Get Paid While Finishing Your Education

Prepare for a Career with Uncle Sam!

When you finish high school in January or June, plan to complete your education in one of the U. S. Army specialty schools. You'll get good pay while learning, plus free board and room, free clothing and equipment, medical and dental care. And you'll share in the U. S. Army's great retirement plan. After you have finished high school, select the army course you want. Get the facts . . . without obligation . . . at your nearest U. S. Army Recruiting Station.

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These are just a few of the courses offered in more than 60 Specialty Schools of the U. S. Army. In these schools you use the latest equipment . . . learn from the finest instructors.

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Springtime means the open road . . . added driving, added mileage . . . and added wear and tear on your car. That's why the wise driver knows that Springtime is Pyroil time, too, because Pyroil wraps a fine film of protective oil around piston and cylinder surfaces, reducing friction wear; carbon, sludge and gum formation. In the weeks ahead, to make sure those added miles of driving will be carefree and trouble-free, remember to add Pyroil . . . and add miles to your car.

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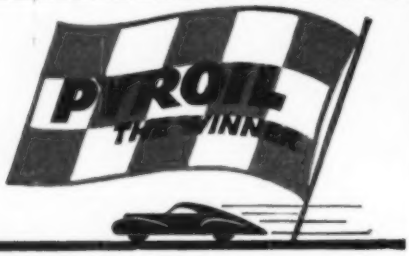
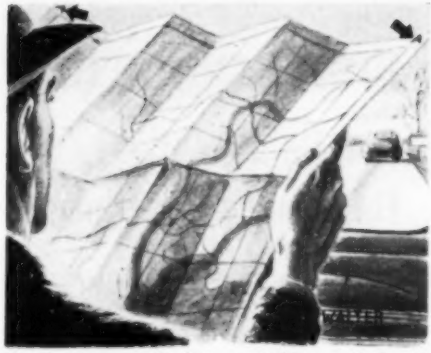
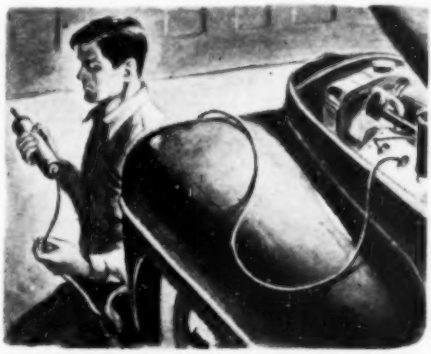


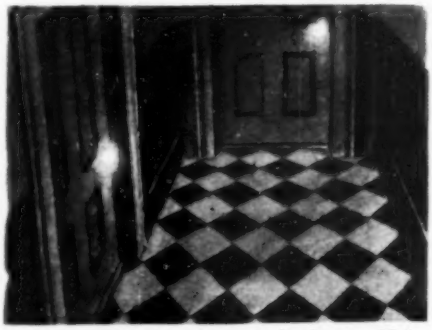
I'd like to see them make . . .



Road maps marked for refolding. If they'd letter or number the creases of road maps, you could properly refold the map just by folding the same numbers or letters face to face.—*Ed Redmond, Corpus Christi, Tex.*



Compression-powered grease guns. By removing a spark plug, you could use engine compression as the muscle for home grease jobs. The gun would need some kind of by-pass valve.—*W. H. Burchett, Tracy, Calif.*



Luminous doorknobs. Such knobs would be an advantage on almost every door. Normally they would receive enough light from daylight or artificial lights to keep them glowing at night. —*Gene Klappench, Wausau, Wis.*

Marlin ANNOUNCES

SENSATIONAL NEW SEMI-AUTOMATIC

New IN PERFORMANCE

Marlin's 88C sets new standards of rapid-fire reliability in the .22 semi-automatic field!

Can you pull a trigger five times a second? This Marlin is faster! What about fouling? Marlin's new bolt and receiver design is virtually foul-proof! There is *no* opening back of ejection port to permit dirt-fouling.

Take-down is simple and fast. Action *cannot* be disassembled if rifle is cocked. Positive sear-locking Safety prevents accidental firing. Breech bolt specially designed to reduce smoke escape and blast to minimum.

Model 88C is a 14-shot tubular magazine semi-automatic rifle. Shoots .22 cal. long rifle ammunition, greased or waxed, regular and high velocity, with lightning speed and remarkable dependability.

American Black Walnut stock. Equipped with hooded ramp front sight and Rocky Mountain rear sight. Barrel length 24"; overall length 45"; weight approx. 6¾ lbs.

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Single or Double Edge
Guaranteed by Marlin—
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BOYS! Be a Ranger! Write Sportsmen's Service Bureau, 343 Lexington Ave., New York, for FREE booklet on marksmanship.

New catalog plus sample pack 4 double* ☐ or 4 single* ☐ edge blades—yours for 10¢ to cover postage, handling. *Check preference.

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"Madame X" was the code name, during research and development, for an entirely new system of recorded music . . . perfected by RCA.

The remarkable background of **"Madame X"**

Now the identity of "Madame X," the *unknown* in a long search for tone perfection, has been revealed. From this quest emerges a completely integrated record-playing *system* – records and automatic player – the first system to be entirely free of distortion.

The research began 11 years ago at RCA Laboratories. First, basic factors were determined – minimum diameters, at different speeds, of the groove spiral in the record – beyond which distortion would occur; size of stylus to be used; length of playing time. From these came the mathematical answer to the record's speed – 45 turns a minute – and to the record's size, only 6⅞ inches in diameter.

The record is of non-breakable vinyl plastic, wafer-thin. *Yet it plays as long as a conventional 12-inch record.* The new RCA Victor automatic record changer holds up to 10 of the new records – 1 hour and 40 minutes of playing time – and can be attached to almost any radio, phonograph, or television combination.

Not only records are free of surface noise and distortion – the record *player* eliminates faulty operation, noise, and cumbersome size, common to many. Records are changed quickly, quietly . . . RCA Victor will continue to supply 78 rpm instruments and records.

This far-reaching advance is one of hundreds which have grown from RCA research. Such leadership adds value beyond price to any product or service of RCA and RCA Victor.

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World Leader in Radio — First in Television

Prof. P. M. S. Blackett, British Nobel-prize scientist and author of the much-discussed, controversial book *War, Fear, and the Bomb.*

PS
The Voice of Science

A Professor Belittles the Bomb

IT is only human to let out that whistling sigh when your long-circling airplane comes out of the white stuff right on the runway; when your disabled car bumps safely off the pavement. Whenever fear lets go of your guts there is a tendency to say, "That wasn't so bad . . ."

Now that we have lived for a little with the unknowns of nuclear fission, it is probably only natural that some people should say, "The A-bomb isn't so bad."

It is only natural that military men, selected for courage and trained for objective sacrifice, should assess the new death only as a weapon. It is their business to counter any new threat with some kind of defense. But while no one who has shared their perils can doubt the integrity of their appraisal, it is possible to question the validity of a military solution to a broad civilian situation.

The most publicized belittler of the A-bomb is not a soldier but a scientist. It is his stature among men of science, most of whom are loud in their warning of atomic wrath, that gives the Professor's views so much weight.

Elsewhere in this issue, POPULAR SCIENCE outlines some of Professor Blackett's arguments and some of the answers (pp. 124-126). Let me urge you to read and re-read these few pages. You are going to hear a lot of people quoting and misquoting the Professor. And you ought to know that in too many areas of argument he is an expert out of his field, and therefore a layman like you and me.

I happen to disagree with Professor Blackett, but I am glad he is getting so much attention. In this lull between the atomic blasts and world understanding, we Americans have put too much faith in fear. Maybe if it were pointed at us we would be saying, "The bomb isn't so bad."

But cutting nuclear fission down to tactical size, saying the atom bomb isn't so bad, won't make war so good. Because the A-bomb as demonstrated in the Pacific and as discussed in Professor Blackett's book will be only the beginning. . . .

Perry Githens

Of course he rates high_he's got P.A.*

P.A.* means Pipe Appeal

The man with a pipe has an extra appeal to the ladies. Fill that pipe with Prince Albert for real smoking joy and comfort!

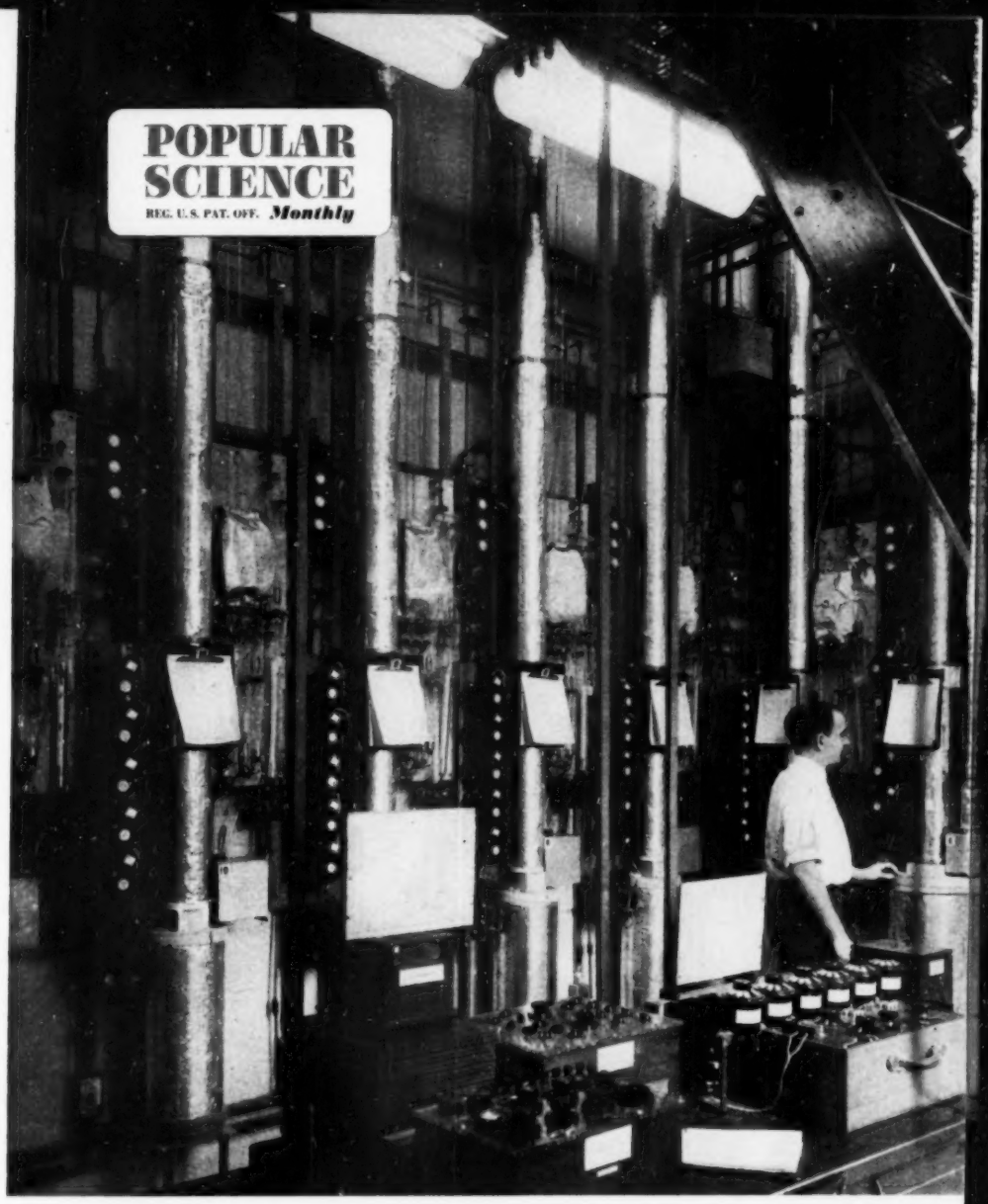
P.A. means Prince Albert

● There are lots of reasons why Prince Albert is known as the National Joy Smoke! P. A.'s choice, crimp cut tobacco is rich-tasting . . . and tongue-easy. Specially treated to insure against tongue bite! Get Prince Albert in the handy pocket tin or the convenient pound size. It's America's largest-selling smoking tobacco!

"FOR CIGARETTE 'MAKIN'S,' P.A. SURE RATES HIGH WITH ME!"

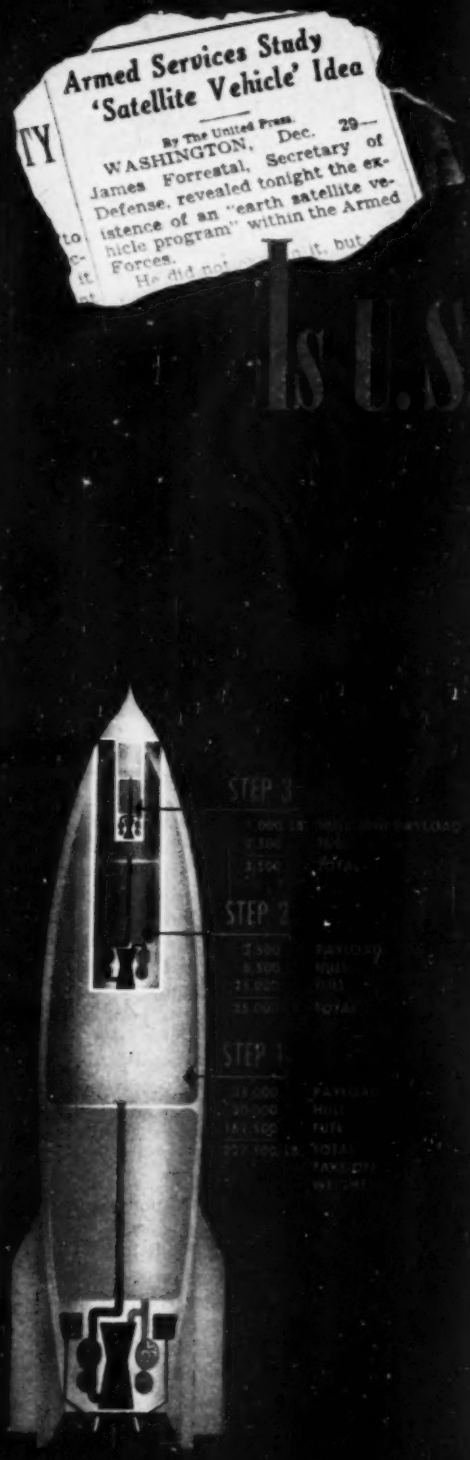
R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

The National Joy Smoke



Pipes for Purity . . . Exceptionally pure chemicals come out of these silvery pipes in the National Bureau of Standards. The two-story-high pipes are automatic distillation columns that boil night and day to separate the compounds of petroleum. Each of these compounds boils at a slightly different temperature, so any one can be separated from most of the others by heating the mixture to just the right boiling point. A few compounds with almost the same boiling point vaporize at the same time, so the condenser tubes (inside tall section) are kept slightly cooler than the pot (lower section). As the vapor rises through the tubes, all the compounds but the desired one are condensed out. Oil companies use the pure samples to identify unknown compounds.

First step of 3-step rocket should carry "satellite" above atmosphere and give it a velocity of about 5,500 feet per second by time fuel in this step is exhausted. Next step should send rocket higher and increase velocity to 14,000 feet per second. Final step should boost velocity to necessary 5 miles per second. At this speed, rocket should become "second moon," circling earth like real moon.



POPULAR SCIENCE

Cover drawing by Ray Pioch

Building a New Moon?

One rocket has already pierced the earth's atmosphere; a faster one might leave it and circle forever.

By Willy Ley
Author of "Rockets and Space Travel"
Drawings by Jere Donovan

THE *Secretary of Defense has co-ordinated "earth satellite vehicle" research by the Army, Navy, and Air Force.*

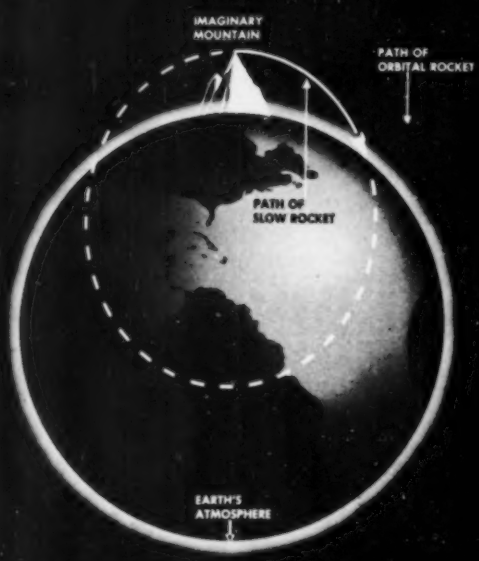
A 3,000-mile rocket-testing range has been requested.

Curtiss-Wright foresees a 10,000-m.p.h. "space ship."

Lockheed's chief engineer says: "Escape from the earth is far closer than most people think."

SUCH revelations made POPULAR SCIENCE editors ask: Is the United States now building a new moon?

No hints as clear as some of these preceded the first A-bomb's shock wave. Space ships, defense officials now say, are "a matter of highest secrecy." So the men who know exactly what's coming up and when are mum or enigmatic. Some of the rumors you may have heard, and some of the headlines, have been preposterous. But, beyond a shadow of possible doubt, American scientists and engineers are working on an "orbit-



Imaginary mountain, towering high above earth's atmosphere, represents point in space where orbital rocket would be launched. Any slow-moving rocket fired from top of this mountain would eventually strike the earth, since it would fall faster than the earth's surface would curve away beneath it. When velocity is 5 miles per second, however, distance rocket falls exactly equals distance earth's surface curves away—eight inches every mile. Thus, though rocket keeps falling toward the earth, the earth keeps bending away from it, and it can never land. Broken line shows how path of slow rocket, if continued, would form ellipse; path of orbital rocket would form ellipse in same way.

er" to spin around the earth like the moon.

A 10,000-m.p.h. space ship might fly around the world, but it would not be, and could never become, a genuine satellite. Even if it were driven by atomic energy, such a go-cart would eventually have to be refueled. The moon doesn't need any fuel. Nor could a 10,000-m.p.h. craft ever slip out of the grip of the earth's gravity. To do that, you'd have to go over 25,000 m.p.h.

Before some Tom, Dick, or Harry takes off like a character in fiction, however, a second moon is likely to become one of the many ramparts watched by America's armed forces.

It won't have anybody in it.

It will never need more fuel.

It will be much smaller, closer, and faster than the moon that makes men croon, but it will be bound just as tightly to Mother Earth's apron strings.

How soon a moon like this will hang overhead depends pretty largely on how much money is spent how fast. I believe that without making a noticeable dent in the national budget an orbiter of this type could be planted in the sky within 10 or 12 years.

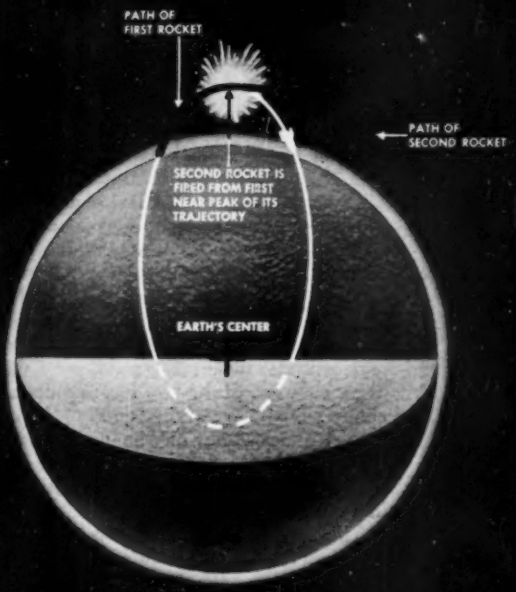
Once a projectile was out in space, a shove of 18,000 m.p.h. would be enough to keep it going around and around like the moon. That velocity could be attained with "step rockets," which are simply two-in-one or three-in-one rockets.

Such rockets are the only known kind that could make full use of a testing range 3,000 miles long. And that, you cannot be criticized for noting, is the length of the range that U. S. defense chiefs now want.

Two-Step Rocket Tried

Much research along this line has already been done (see "Going Up for Keeps," PS, March '47, p. 66). Late last February, the Army set off a two-step rocket at White Sands, N. Mex., that reached an altitude of 250 miles and a velocity of 5,000 miles an hour, both record achievements. Much more research, however, remains to be done.

The sketches on pages 106 and 107 show how a three-step rocket might plant a small, manless moon in the sky. The sketches on these pages show why a velocity of 18,000 m.p.h., which is 5 miles per second, would keep it up until doomsday if nothing knocked it off its course.



Using two rockets, one fired from the other, would accomplish same thing as launching single rocket from imaginary mountain on previous page. First rocket, fired nearly straight up, would carry to well above earth's atmosphere. Then second rocket, fired from first one near peak of its trajectory, would be placed in path almost at right angle to earth's radius. This rocket, traveling at 5 miles per second, would then enter permanent orbit around earth while first rocket dropped back. Actual attempt would probably require 3-step rocket, but principle would be the same. Note that two rockets' elliptical paths would both have earth's center as one of their two focal points.

A cargo of instruments permanently placed above the blanket of air in which we dwell could tell us a lot of things that no one knows now. If, say, the instruments were to weigh 200 lb. (which is a lot of instruments nowadays), and the cart in which they were placed were to weigh 800 lb., they could be accelerated to 18,000 m.p.h. by a step rocket weighing a trifle less than 119 short tons.

This could be done with known fuels. How the total weight would be divided among the three parts of the rocket is indicated alongside the drawing on page 107. I have assumed, in these computations, that in each step the ratio between the total fueled weight and the combined hull and payload weight would be 3.5 to 1 and that the velocity of the exhaust blast would be 7,500 feet per second. These are plausible assumptions, and my conclusions are based on Newton's third law of motion.

The rocket the artist has pictured would be 120 feet tall, about the height of a 10- or 11-story building.

Such a monster does not seem fantastic when you recall the disclosures since the war. A V-2 rocket is 46 feet high and weighs 15 short tons when it takes off. The Nazis were found, however, to have a far bigger job in the works. Intended to cross the Atlantic and bombard us, it was to be a two-step rocket with a take-off weight of 93 short tons (PS, Oct. '47 p. 108).

The Germans knew that step rockets would actually work. They used a small, three-step, solid-fuel rocket called the Rheinbote ("Messenger from the Rhine") for long-range bombardment work during the battle for Antwerp. That American experts who have picked the Germans' brains are working on booster rockets is no secret (see p. 116).

To an uninformed bystander, a three-step rocket capable of delivering a half-ton moon might look like a single one. Since the two inner rockets would operate above the atmosphere, they need not be streamlined. They could be fitted into the hull of the first big booster without a cubic inch wasted.

Such a mighty missile's ascent would begin rather slowly. The air would offer less resistance as it climbed and it would gain speed faster. At 30 miles up, it should be going about a mile a second.

To get it out of the dense, lower atmos-

Time required for orbital rocket to make complete revolution about earth depends only on distance away, which determines how far it must go to get around. Drawing above shows orbiter's movement at three different altitudes. At 22,300 miles, rocket would take 24 hours to complete full revolution and would thus appear fixed over earth. At 3,100 miles, it would require 200 minutes; at 470 miles, only 100 minutes.

phere as quickly as possible, the rocket probably would be shot straight up. Then the trajectory could be slowly tilted. The deviation from a vertical path might not be more that 15° during the first step. This tilting from the vertical might increase during Step 2 and continue to do so in the final step until the rocket traveled along a line at a right angle to the radius of the earth during the last few seconds of its fuel's burning time.

But for the resistance of the air when the rocket first left the earth, it should be going 5 1/3 miles per second then. That's over a third of a mile per second faster than necessary, but much of this excess would have been lost while the rocket was passing through the atmosphere.

At a velocity of 5 miles per second, the rocket's directional inertia—the tendency to keep on a straight path—would combine with the force of gravity—tending to pull it earthward—to set it on a curving path around the earth. These forces of inertia and gravity keep the moon in its orbit and the planets in theirs, and they would keep this scooter full of instruments circling the world in a similar orbit.

The trajectory of every long-range or high-altitude rocket is an ellipse, and in every case one of the two focal points of the ellipse coincides with the center of the earth. The orbiter would be no exception. Its orbit would be an ellipse, but this ellipse might be so short and fat that in a small drawing it would look like a circle.

The time required for a complete revolution around the earth would be governed by a single factor: the new "moon's" distance from the earth. The farther it is from us, the longer it will take to go around.

Choose Your Orbit

If the distance from the ground were 470 miles (probably the minimum if we want to be sure to avoid even the last faint traces of air resistance), each complete revolution around the earth would take 100 minutes. This has the interesting result that the orbiter, when observed as a star, would "rise" in the West and "set" in the East. (It is assumed that it will be launched so that it would circle in the same direction as the earth rotates.) If its orbit were in the plane of the equator the rocket satellite could not be seen at all from higher northern and southern latitudes because the bulk of the earth would be in the way of the observer.

If the "orbiter" were to be placed 22,300 miles from the earth's surface, it would neither "rise" nor "set" because it would need just 24 hours for one revolution and therefore seem to stand still over one spot. While this might be amusing, the scientists would probably prefer to have their sky wagon move with respect to the ground.

It also would be advisable for several reasons to have the rocket closer than 22,300 miles out, the limited range of the telemetering instruments being one of them.

One of the many mysteries that the instruments could clear up is the temperature the orbiter itself would assume. Space itself, being empty, cannot have a temperature, but

everything material put into space will assume one, since it will receive radiations from the sun and radiate energy in turn. How much will be absorbed and how much will be re-radiated will depend on the orbiter's surface smoothness, its heat conductivity, its color, and many other factors.

Another interesting phenomenon would be the drop in temperature when the orbiter entered the shadow of the earth, as it would once during every revolution. Knowledge of this temperature fluctuation would be of great interest to designers of long-range missiles that might take off at night in the earth's shadow and then leave it, or vice versa.

Would Aid Solar Research

The instruments on the new space sled could also relay a complete spectrum of the sun. Spectra taken on the ground lack large sections that are cut out by the atmosphere. More complete spectra have been obtained by means of high-altitude rockets, but these rockets stay at a high altitude for only a very short time, and their attitude at peak altitude cannot even be guessed in advance.

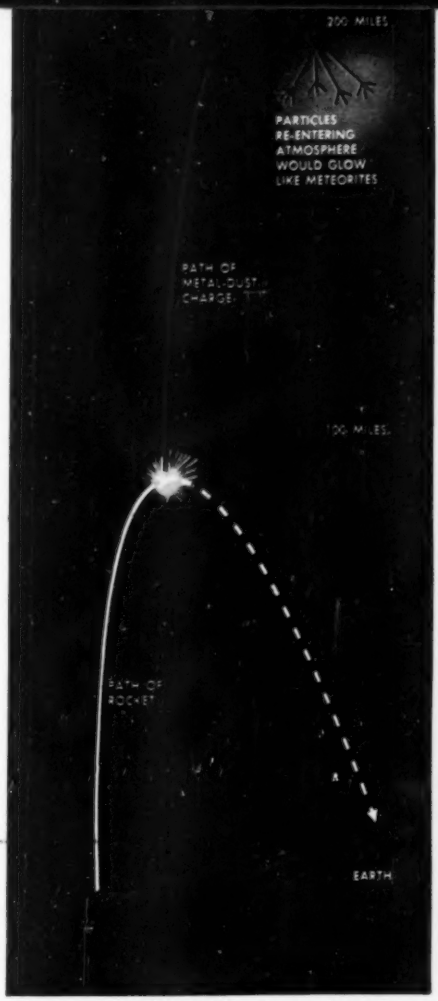
Another item of solar research the orbiter could help explain is sunspot activity. Scientists suspect that clouds of ionized hydrogen gas from the sun wander through space. The orbiter's instruments could provide definite information about them.

It might also be possible to equip the new moon with an instrument to send out a special signal if the rocket should be hit by a meteorite. That would settle, once and for all, the perennial question of the probability of getting your skull smashed by a meteor when you stick your head out of the earth's atmosphere.

Such an instrument probably would not be set off by the impact of individual particles of cosmic dust, but in time these might change the temperature of the rocket by reducing its light-reflecting power. If the effect should be very strong, which is unlikely, it could even reduce the orbiter's visual brightness.

To send findings back to the ground, the instruments would need a source of power of some sort. Batteries might not last long enough. It might be possible, however, to obtain the necessary power from the decay of radioactive substances in a manner that, if developed, would certainly be top secret.

Perhaps the sun's energy could be used for this purpose. It should be possible to devise thermoelements that, when heated by the sun at one end, would produce enough electric current for this purpose. Rather long antennas could be provided quite easily by having coiled-up steel wires in the head that would be released after the acceleration of the rocket stopped, sticking out as shown on the cover. These wires would also increase



Attempt to put "artificial meteorites" into space was tried by Army more than a year ago by firing "shaped charges" from the head of a V-2 (PS, March '47, p. 66). Consisting of a sheet-metal "liner" blasted apart by high explosive, the charges produced a high-speed jet of fine metal dust. It was hoped that some of the metal particles, fired from the V-2 100 miles up, would carry an additional 100 miles or more, leave the atmosphere, and then be detected upon re-entering. Whether or not experiment was successful has not as yet been made public.

the size of the orbiter and make it a better radar target.

This brings us to the "passive" uses of such a vehicle—uses that would result simply from its existence. The problem of guiding very long-range missiles—say 3,000 miles or more—always raises the question of reference points. Astronomers are apt to point out that the star Regulus would be a fine reference point for various reasons. That would no doubt be true for space ships manned by navigators trained to recognize Regulus when they saw it. But a mere guiding mechanism might conceivably be fooled by a few dozen other stars. Even a robot, however, should not mistake an orbital rocket, from which a radar signal could be bounced back, for a distant star.

Navigating by Orbiter

Designers of guiding mechanisms for missiles are working on four methods. One is a two-beam system, with one beam on the target and one on the missile to provide it with orders that originate on the ground. The second is a one-beam system in which the beam is put on the target and the missile's mechanism is so designed that the missile returns to the beam whenever it accidentally leaves it. The third is the so-called "homing" mechanism. And the fourth is to teach the missile to do its own navigating. But when the navigation must be done over very long distances, it must be celestial navigation—and that is where an orbital rocket could be helpful.

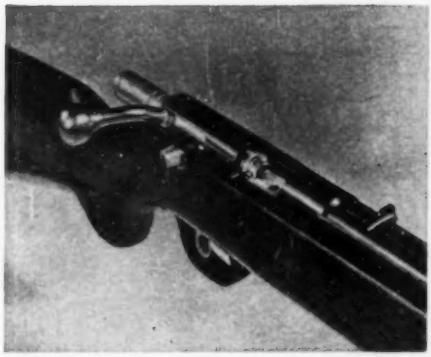
It could perform similar service, of course, for a human navigator. If the orbiter could be made "visible" (not necessarily to the eye) to navigators of ships and aircraft, it would be a fine reference point for them. These human navigators have reference points now in the natural celestial bodies, but navigating by them at high speeds with portable instruments is not easy. An orbiter traversing almost two degrees of arc every half minute, along a predetermined course, would be a big help.

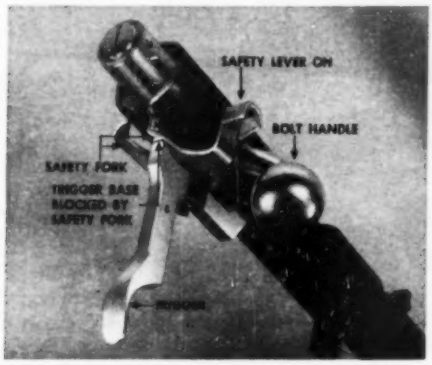
The idea is old. Computing the natural moon's orbit is such a tedious, difficult task that a French astronomer suggested a century ago that there ought to be a second smaller moon. None was ever found. But you may live to travel in a 10,000-m.p.h. plane, led to its destination by a man-made moon that simultaneously is radioing essential information to the engineers designing a ship for the first flight to Venus. END

Army's two-step rocket cleared most of earth's atmosphere when it reached record height of 250 miles. Consisting of small Wac Corporal fired from nose of larger V-2, it also hit record speed of 5,000 m.p.h. Orbiter would have to go 3½ times faster but less than twice as high.

Rifle Safety Can't Forget

HERE's a rifle that you can't load without automatically locking a fool-proof safety device. It is a new .22-caliber, single-shot, bolt-action Winchester (right) designed especially for young and inexperienced shooters. The very act of loading, pulling back the bolt handle, makes it impossible to fire the rifle. And with the cartridge in place, you can't shoot it until you manually push back the safety lever, uncovering a red warning dot. The Model 47, taking either .22 short or long cartridges, with a choice of sights, sells for around $20.





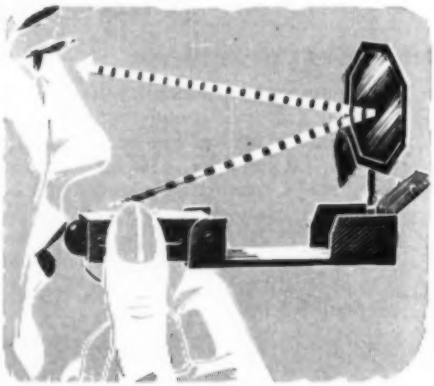
The action of loading, as illustrated in above photo, pushes back forked safety lever. One tine of the fork gets in the way of trigger base and prevents it from hitting the firing pin.

With safety lever forward in firing position, fork moves aside and trigger base is free to move upward between tines to strike the firing pin. Cartridge cannot be locked if safety is off.

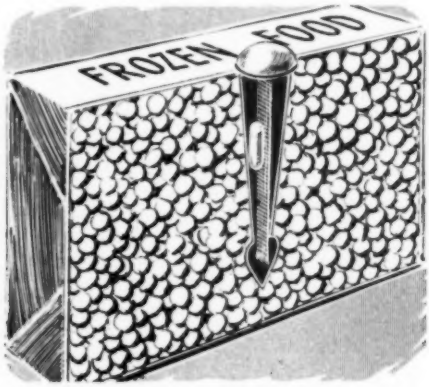
Parajumpers Carry Own Teletypewriter

A LIGHTWEIGHT portable teletypewriter, weighing only 45 pounds, is the Signal Corps' answer to front-line communications problems. It can operate on both wire and radio circuits, sending and receiving 66 percent faster than older types. It is light enough to be carried on a jump by a paratrooper. A power unit and case only bring its total weight up to 116 pounds, as against 400 pounds for present models.

Spoilers Smooth Landings. If you came down in this plane, you'd stay down. "Spoiler" vanes on top of the wings are automatically raised just as the plane lands, cutting its lift and keeping it from "bouncing." The spoilers are actuated by the movement of the shock absorbers as the wheels strike the ground. For take-offs, they lower when throttle is opened. E. M. Gardner, of Barberton, O., is the inventor.



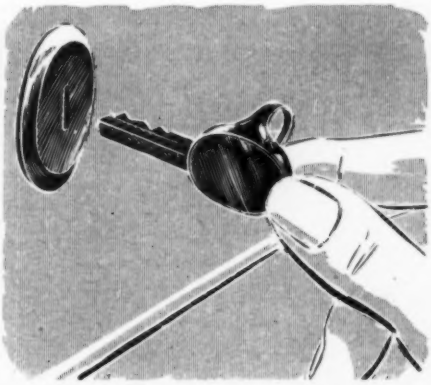
Lipstick Has Mirror. Women would have less trouble getting their lipstick on straight with this novel container. Patented by D. Macy, of New York City, it has a small mirror that opens out at the end of the lipstick, keeping the user's lips constantly in view. When not in use, both lipstick and mirror fold compactly together.



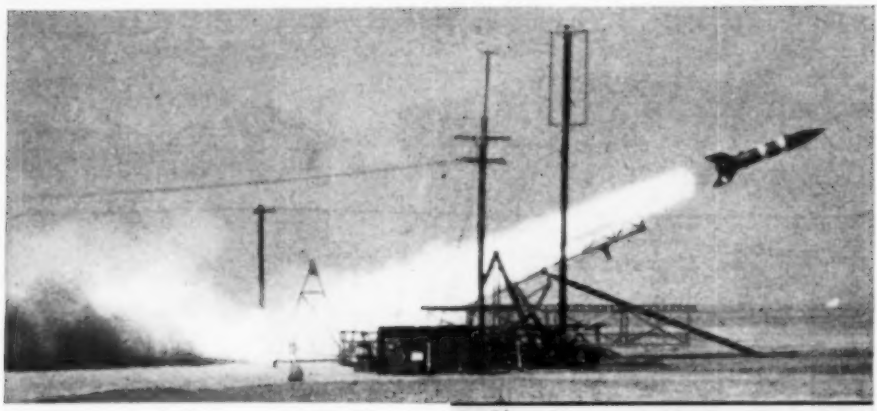
Chemical Warns of Thaws. This telltale would reveal if a frozen-food package had thawed inside and been refrozen. With the food, a capsule of water is frozen, bursting its walls. If the food thaws, the ice melts, and a wick wets a chemical, visible through the wrapper, changing its color. Inventor is K. Chase, of Wilmington, Mass.

Tire Support Speeds Changing. This simple support would save wrestling with a heavy car wheel while trying to put it on. Just rest the wheel on the end of the arm and slide the whole thing under the car. Pushing down on the spring-action arm allows the tire to be slipped under the fender. Letting go then raises the wheel so it can be placed easily on the axle. J. A. Laclair, of Flat Rock, Mich., is the inventor.

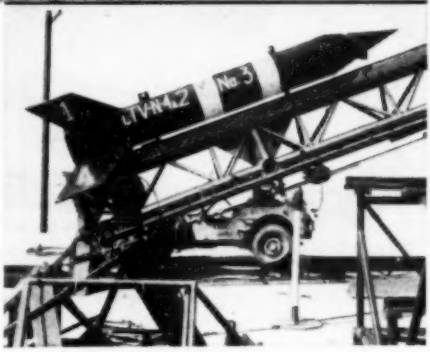
Tone Arm Cuts Distortion. This tricky phonograph pickup arm, invented by H. L. Shortt, of White Plains, N. Y., is designed to eliminate tracking distortion by always following a record's grooves at an exact tangent. As the pickup head moves inward, rods connecting the two parts of the hinged arm turn it to keep it tangent.



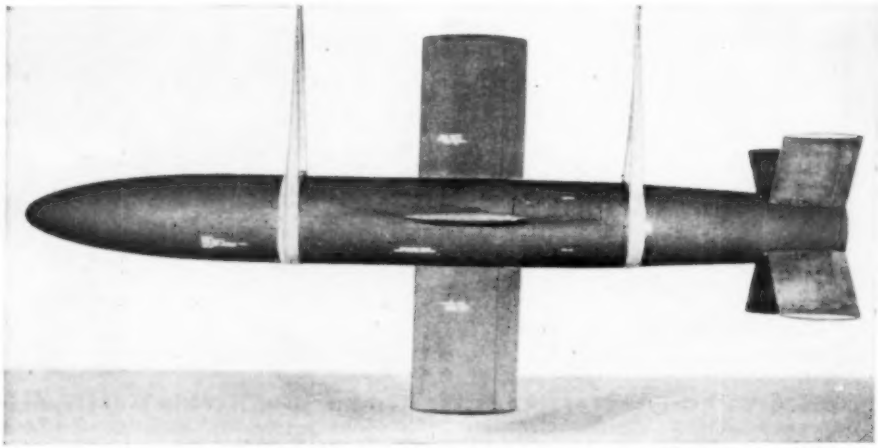
Finger Ring Holds Key. You'd be less likely to lose or forget that vital house key if you kept it in this novel finger ring. Invented by H. H. Boscowitz, of New York City, it holds a key that slides out from a recess in the underside. When extended, the key is locked by a spring catch, keeping it from sliding back when pushed in the lock.



Swift Kick for Missiles

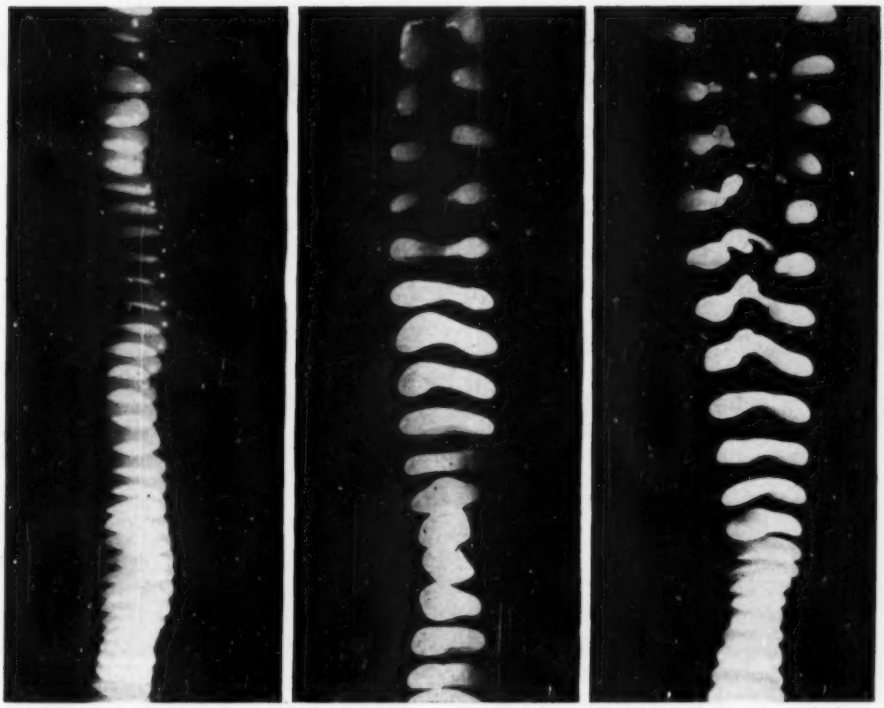


THE Navy's newest booster rocket, with a speed of more than 1,500 m.p.h., will get supersonic missiles off to a good start. It is designed especially for launching ramjet missiles that must reach near-supersonic velocity before they can operate efficiently. As shown on launching ramp at right, the solid-fuel rocket has a dummy nose. When the rocket is used as a booster, however, it will be attached to the tail of the main missile, then dropped off after the ramjet engine reaches self-operating speed.



Secret Weapon Previewed

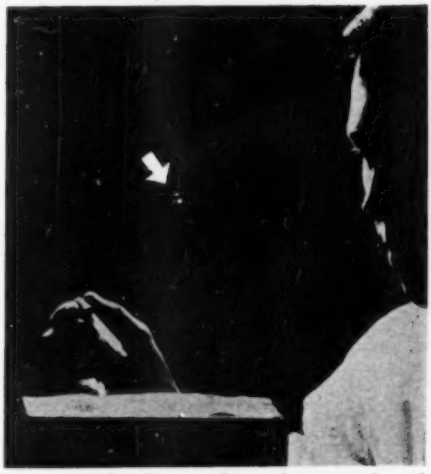
SHOWN above, posing on its way for delivery to the U. S. Navy, is the Lark, latest weapon of push-button warfare. It is a ship-to-air, rocket-powered guided missile, controlled automatically in flight. That is all the Navy will say about the new weapon, intended to knock targets out of the air, except that it has been designated the XSAM-N-2. Research and development is by Fairchild Engine and Airplane Corp.



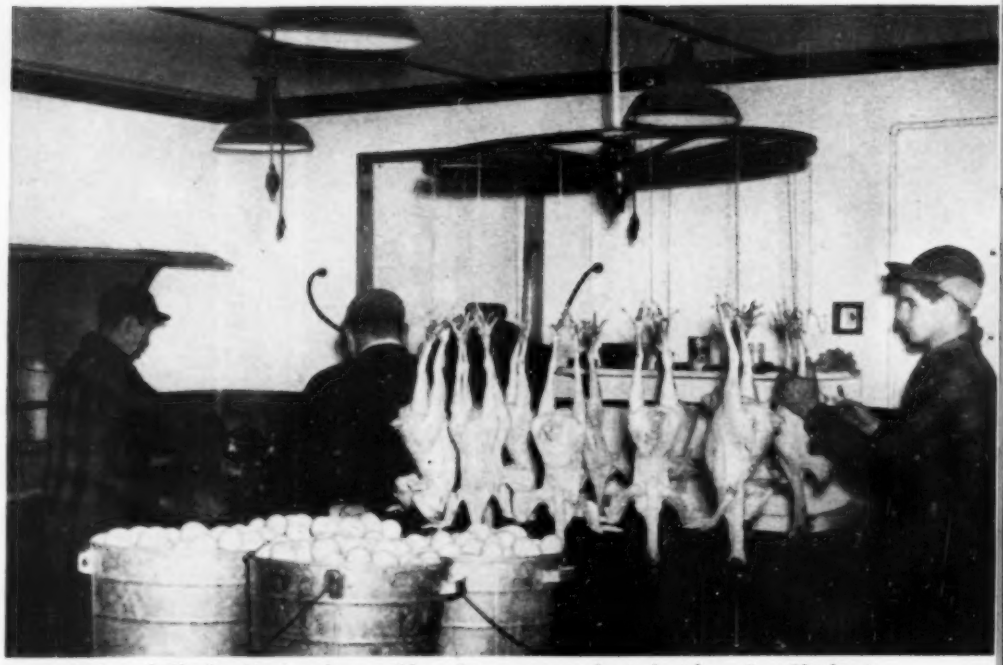
Multiple high-speed photos, beginning at bottom, reveal successive shapes of a raindrop buffeted by air stream as in falling from sky. Pictures illustrate typical button-shaped drop; "dumbbell" drop dividing in two; and "phone-set" drop breaking into large and small pieces.

How Raindrop Really Looks

WHEN you're caught in a shower, do you picture yourself getting splashed by tear-shaped raindrops like those sketched at left? Contrary to popular belief, raindrops are not tear-shaped—nor would tears be, if they fell far. For a good look at a raindrop, General Electric scientists released water from a medicine dropper into a rising air stream that carried a drop, "falling" naturally in air, slowly upward past a high-speed multiple-exposure camera. Its pictures show that small raindrops actually are shaped like marbles or footballs. Large drops may resemble buttons, dumbbells, pancakes, gourds, telephone sets, or disk-shaped, "flying saucers." Oscillations change the shape up to 50 times a second.



Drop of water from medicine dropper, released in rising air stream, is carried slowly upward (arrow) as camera records its changing shape. The air moving upward past the drop produces the same effect in a few inches as if the drop had fallen a long distance through the air.



General view of Charley Nassivera's assembly line shows latest in poultry farming. Charley, left, dunks a bird in automatic scalder. Brother Leon runs mechanical picker. Son Charles is singeing. Dunker, singeing wheel, and mechanical egg cooler in foreground are all homemade.

Homemade Gadgets Mechanize Chicken Farm

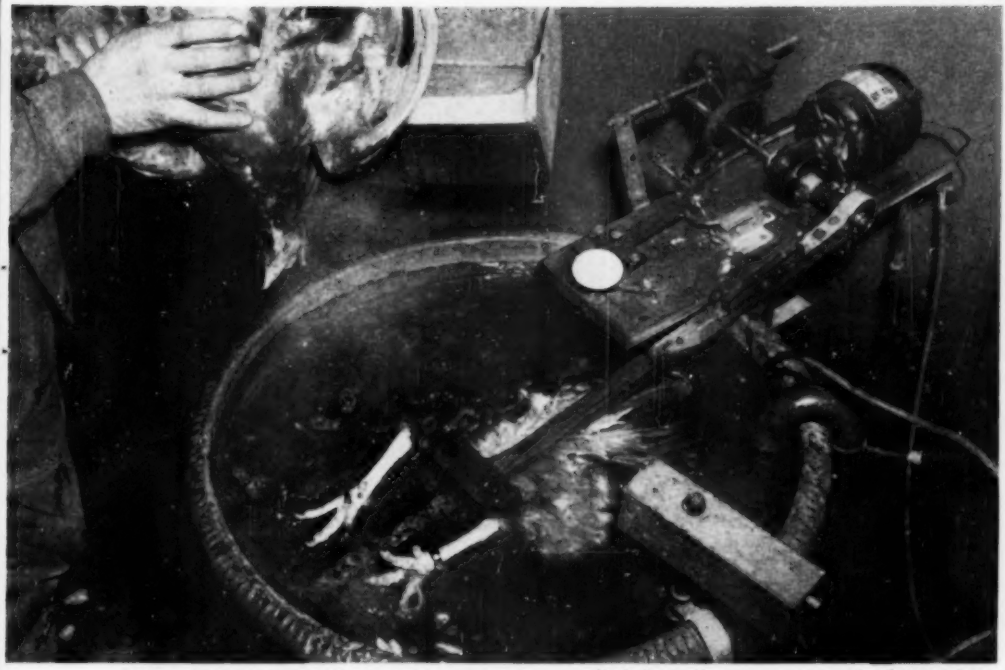
To solve heating problem in fowl-dressing room, Charley installed auto radiator to circulate hot water from another part of building. Motor drives old Chevrolet water pump and fan.

THEY laughed when Charley Nassivera began monkeying with worn-out clocks, discarded automobile radiators, and spare wagon wheels to mechanize his chicken farm. But Charley has the last laugh.

Charley, who lives near Glens Falls, N. Y., got plumb tired of all the work that it took to scald a chicken, pick it, and singe it to get it ready for the consumer. So he put his chickens on an assembly line.

Take his scalder, now. He calls it the dunker. It was assembled from parts of a washtub, a lawn sprinkler, a doorstop, and a rebuilt motor. That motor is just one of 42 on his farm that keep production humming.

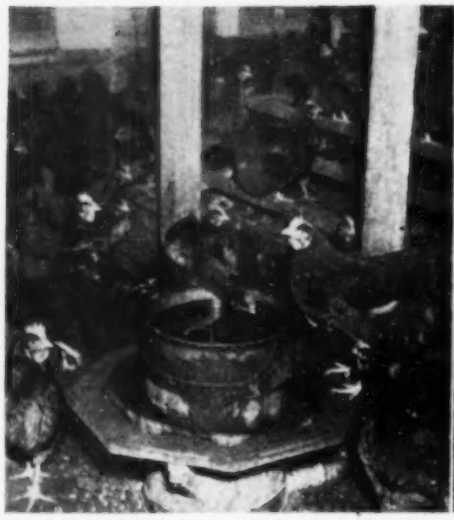
Charley has the last laugh because his Coblenol Farm has been top-rated by a big university's efficiency experts. And with his labor-saving devices he makes more money and produces better chickens and eggs.



In Nassivera's automatic scalder, agitator arm gives a bird an elliptical up-down motion. Two electric heating units, thermostatically controlled, keep the water at an ideal 128° F. to loosen the feathers. Labor-saving devices have cut cost of dressing a bird from 45¢ to 7¢.

Mechanical picker has rubber fingers to take off feathers, eliminating drudgery of hand-plucking. It's the only "store-boughten" gimmick of all fancy devices on Nassivera's farm.

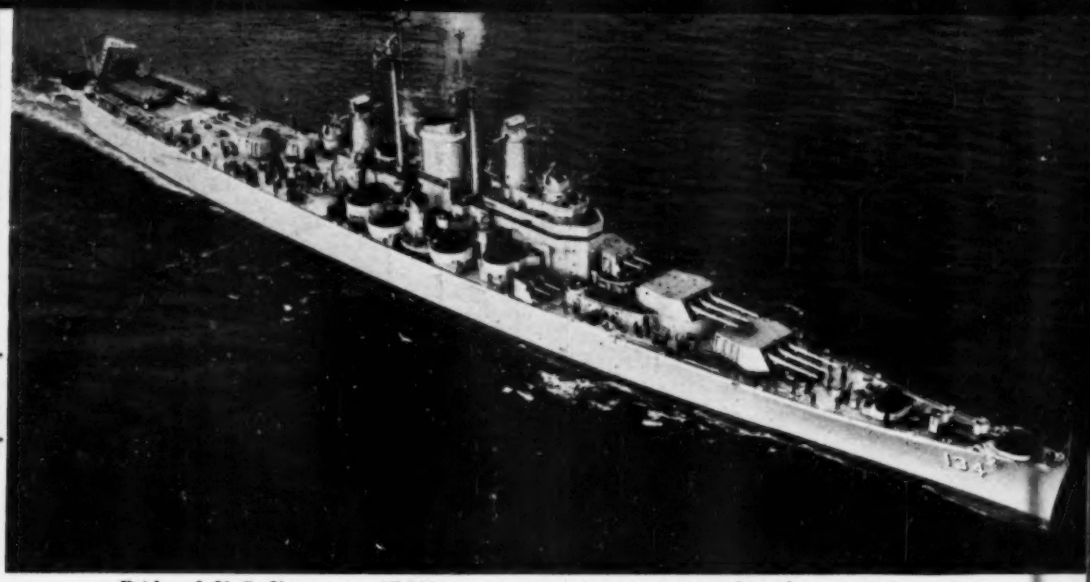
Buggy wheel, with hooks for 14 fowl, simplifies singeing. Coblenol Farm even makes day-old chicks—of special New Hampshire strain—count themselves as they are boxed.



Time-consuming chore of watering chickens is eliminated by automatic, non-freezing, self-draining system. Flow is regulated by float-arm valve. Water is warmed to induce hens to drink more, produce more eggs. At right, close-up of watering invention shows the heating coil.

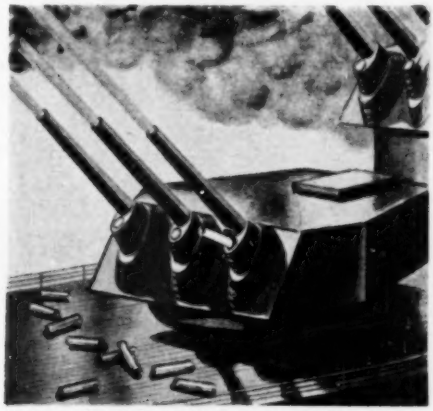
To cool eggs without harmful drying, Charley shoots moist air into cabinet through old insecticide gun. Fan is in revolving drum set partly in water. Clock from electric range is timer.

Leon Nassivera brings eggs down in four-story hen house, using brother's homemade elevator. Run by 3-hp. motor, it rides on half-inch steel cable wound on drums from rear end of a Willys.



Pride of U. S. Navy, new 17,000-ton cruiser *Des Moines* is manned by more than 1,000 officers and men, betters 30 knots, and mounts nine automatic eight-inch guns, 12 five-inchers, and 20 three-inchers, plus 12 20-mm. machine guns. Twin catapults launch four seaplanes.

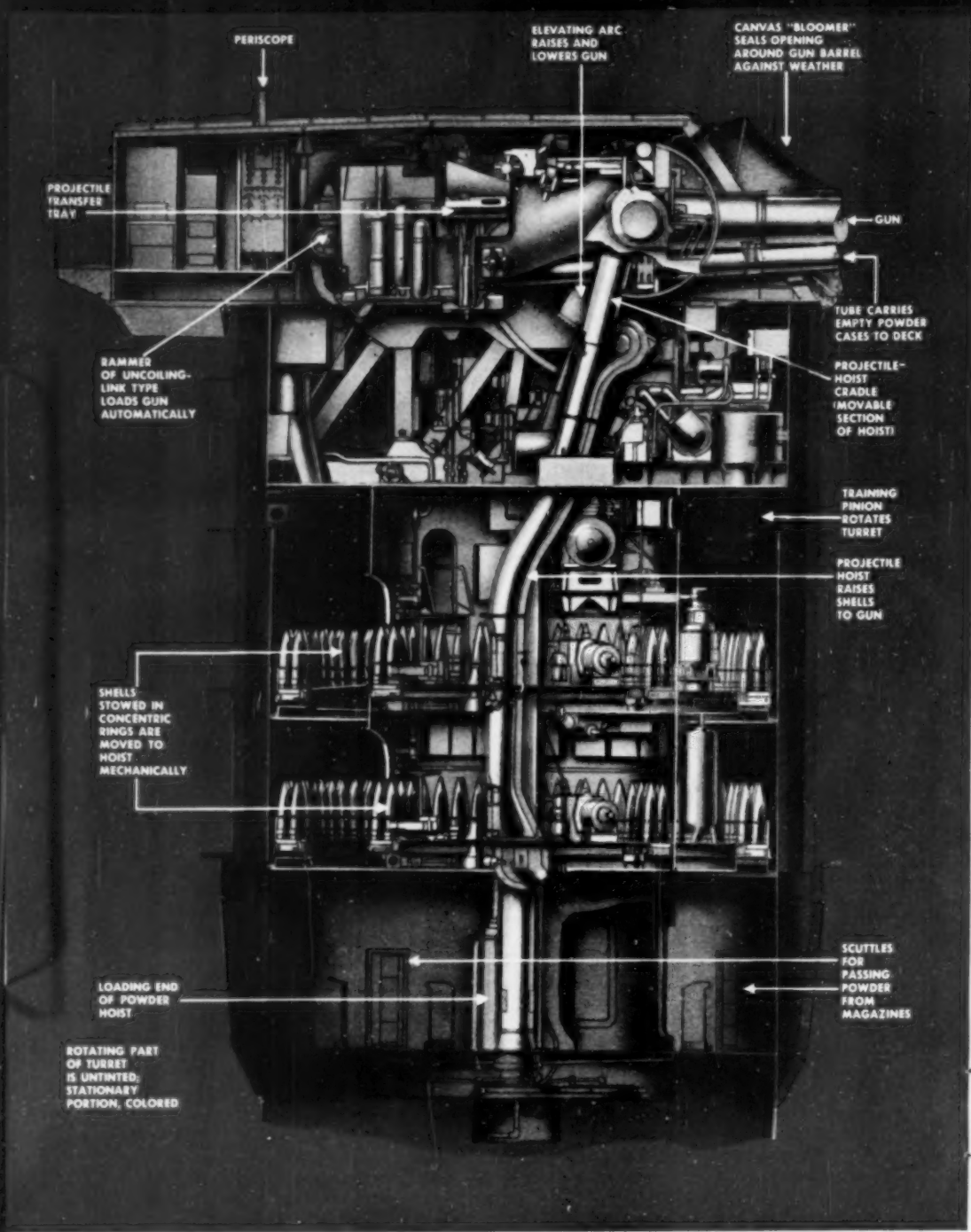
New Cruiser Packs 8-Inch Automatics



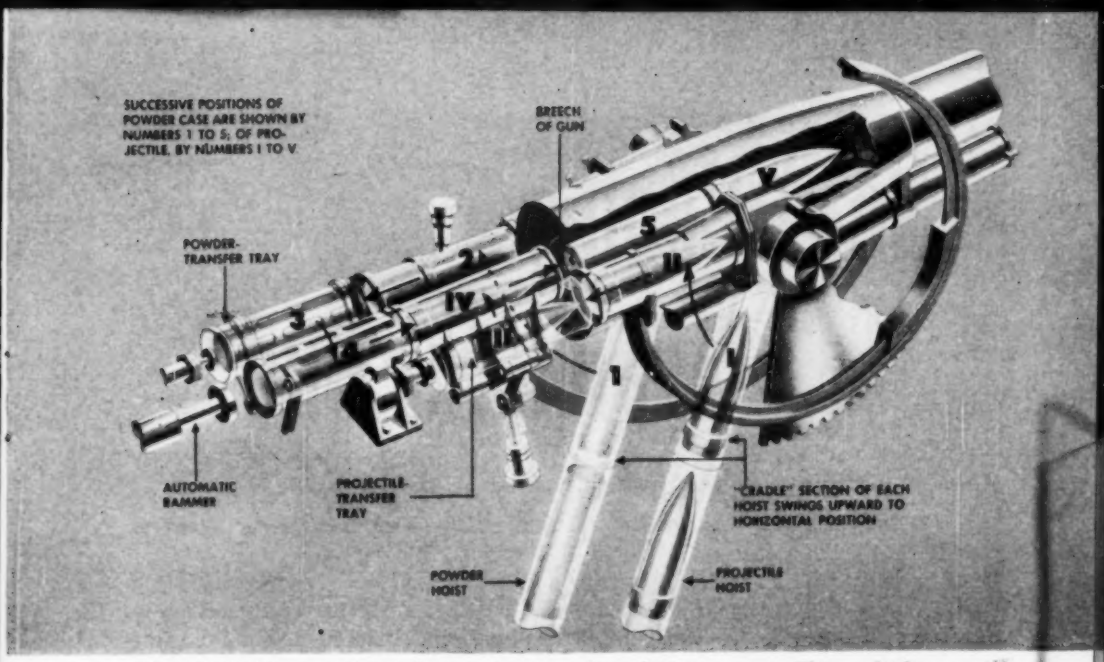
Automatic eight-inch gun turret in action is visualized by artist. New guns use powder in brass cases, instead of silk or nylon bags, and empty cases are ejected onto deck as shown.

AUTOMATIC eight-inch guns, first of this large caliber to be perfected, quadruple the fire power of the U.S. Navy's new 17,000-ton cruisers. They make the U.S.S. *Des Moines,* completed last November, and her sister ships *Salem* and *Newport News,* due to join the fleet this spring, the most powerful warships of their class afloat. Outweighing battleships of only four decades ago, these heaviest of our "heavy" cruisers each mount a main battery of nine of the automatic eight-inchers, six in two triple turrets forward and three in one turret aft.

Transferring powder bags and shells from hoists to gun by hand, formerly a task of sweating turret crews, has been eliminated. Ingenious mechanisms designed by Bureau of Ordnance engineers make the big rifles fully self-acting from ammunition-handling rooms to gun muzzle. Consequently, the Navy says, they fire at least four times as fast as any gun of their size used before. Since a good hand-loading crew can pump out about two rounds a minute, that would



Cross section of automatic eight-inch gun turret on new cruisers shows how projectiles, stored in concentric rings below deck, are fed to gun by tubular power hoist. Similar hoist, on far side, raises powder in brass cases from magazines. Part of mechanism that transfers shell from hoist to gun is seen at top. Each turret contains three guns like the one shown.



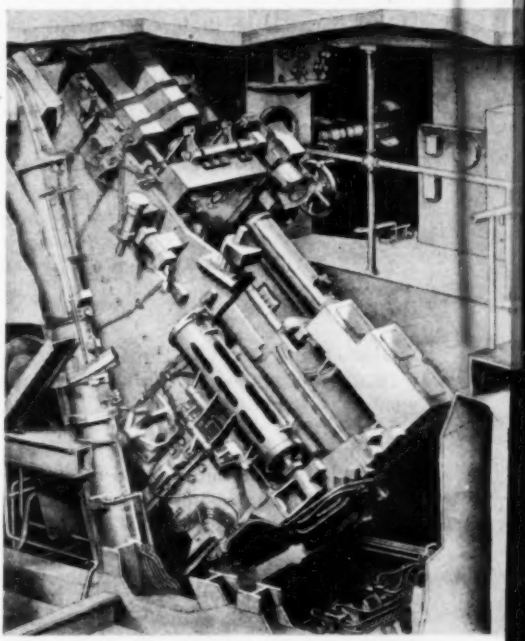
Simplified diagram shows how automatic mechanism of new turrets replaces slow and laborious hand transfer of shells and powder from hoists to guns. This multiplies normal rate of fire of eight-inch guns at least four times. Each gun has its own pair of hoists.

mean that one of the new cruisers could throw a broadside of nine 334-pound, armor-piercing shells at least eight times a minute, or once every 7½ seconds.

How the rapid-fire big guns work can now be revealed, with U. S. Navy sanction. One of their secrets is substitution of brass powder cases for powder bags of silk or nylon. Synchronized with the rate of fire, tubular power hoists raise powder cases and projectiles from deep in the ship.

At the top of its hoist a powder case enters a movable section that serves as a cradle, compressing a spring as it does so. The cradle then swings in an upward arc to gun position. Here a trigger trips the spring, and the powder case is ejected rearward into a transfer tray, which swings on a pivot to bring it into line with the bore of the gun. Simultaneously, a similar mechanism swings a shell into place just ahead of it. An automatic rammer shoves both into the gun, the breechblock slams shut, and the gun fires. As it recoils, the empty powder case is extracted, and ejected by a chain-driven conveyer to the deck outside.

Unlike former types, these guns reload at any angle of elevation. They fire singly or in salvo, and may be used against either ships or aircraft. END



Official Navy drawing gives close-up, cutaway view of new automatic eight-inch gun from within turret. Tube at left is the powder hoist, and slotted cylinder is powder-transfer tray.

So A-Bombs Aren't So Bad?

Two debunking books have started a lively and important argument in scientific and military circles.

P. M. S. BLACKETT, a Nobel prize winner in physics, thinks Americans have exaggerated the A-bomb's importance. R. E. Lapp, a Manhattan Project physicist, fears that people are hiding from the facts. Prof. Blackett defends the Russians' attitude toward the bomb; Dr. Lapp is mainly concerned about America's security. Prof. Blackett's book, *Fear, War, and the Bomb,* started a hot and important argument among scientists and military authorities, which now has been intensified by Dr. Lapp's new book, *Must We Hide?*

Both men base their contentions largely on reports of the United States Strategic Bombing Survey (USSBS). Volta Torrey, PS managing editor, helped prepare part of those reports. Here are some of Blackett's and Lapp's most interesting opinions, followed by Torrey's explanations, comments, and questions:

BLACKETT SAYS: "One improved atomic bomb can be considered as the equivalent of about 3,000 tons of ordinary bombs."

LAPP SAYS: "The problem of atomic defense is a great one, but it is not hopelessly great."

Blackett's figure (3,000 tons) is based on a comparison of the A-bomb's effectiveness against brick walls at Nagasaki with that of a blockbuster. Comparing the number of buildings actually destroyed or damaged previously by other bombs with the number wrecked by the A-bomb shows the latter was closer to an equivalent of 15,000 tons of ordinary bombs. And comparing the number of people killed by other bombs in Japan with the number killed by two A-bombs shows that each A-bomb was as lethal as about 40,000 tons of the other bombs.

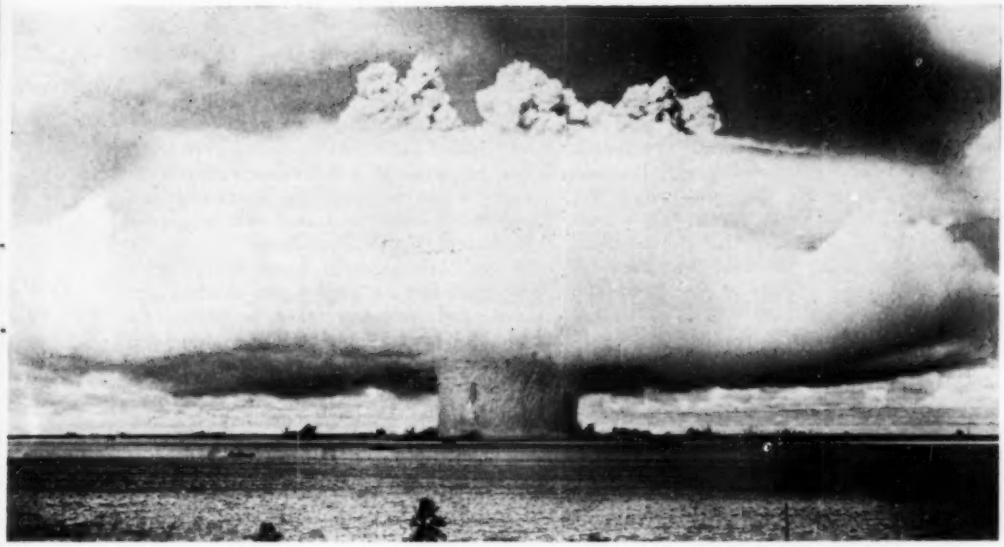
But all such comparisons are tricky. A-bombs differ from blockbusters the way X-ray machines differ from firecrackers. How many firecrackers would you need to X-ray a tooth?

Lapp points out that people can be shielded from the A-bomb's radiation, and argues that more victims could be saved than were in Japan, but admits that no one has enough genetic information yet to be sure about the radiation's effects on future generations.

BLACKETT SAYS: "Some 400 improved atomic bombs would be required" to do what 1,300,000 tons of ordinary bombs did in Germany.

LAPP SAYS: "After absorbing 75 A-bombs, Germany would not have been a very productive nation."

The USSBS found that air raids on cities and light attacks on industries in the first part of the war were disappointing, but that the heavy attacks on German oil and transportation targets were decisive. Knocking



out a small number of oil plants deprived the Germans of fuel for their planes and panzers. This enabled the Allies to control the air and shove back the blitzkriegers.

These findings show that 400 A-bombs could be wasted against a nation such as Germany, but a small number of A-bombs in the right places could be decisive.

BLACKETT SAYS: "The number of atomic bombs required to produce decisive military results will increase with the area and population of the country under attack."

LAPP SAYS: "Because so many bombers may be able to penetrate our defense net, it is most important that we consider every possible measure which may reduce the effectiveness of the bombs that are delivered."

An elephant is bigger than a mouse but can be killed with one bullet. Do not nations, too, have nerve centers, regardless of their size? The U. S. has about 40 cities as big or bigger than Nagasaki. Russia has about the same number. How many of those cities could either nation spare?

Lapp urges that American cities be spread out more. The Russians have more space in which to spread out. But a bomber can now reach any point on the earth's surface. No conceivable wall of radar, fighters, guided missiles, and guns would intercept every bomber if enough planes were assigned to a target. Against an A-bomber that reaches its target only two defenses are possible: hiding and hitting back. Both would be risky.

BLACKETT SAYS: "Repeated deep penetration of a heavily defended territory is likely to be an expensive operation."

LAPP SAYS: "The atom bomb has not made war cheap."

Both authors are right. Fewer penetrations would be necessary with A-bombs than with other bombs. But A-bombs are expensive. So are delivery planes. So, too, are defenses.

BLACKETT SAYS: "The power of human beings to 'take it' is immense; a determined people will learn to stand atomic bombordment."

LAPP SAYS: "Could not an initial air blitz of Russia succeed in breaking the will of the people to resist? . . . No one really knows."

Submarine crews and men for other hazardous duties are chosen carefully, then specially trained. Some people can "take" almost anything. Others simply can't. So some people undoubtedly could learn to stand atomic bombing. But how many?

Winston Churchill doubts whether the British people's reactions would have been as healthy as they were if the air raids on

Britain had been much heavier. The Germans endured heavier attacks later, but the USSBS ascribed this to "the power of a police state" over them.

Would that power—to control people's information and actions—suffice against the additional horrors of A-bombs? In Japan, every pregnant woman within about a mile and a quarter of the A-bombs whom the USSBS could find later either had a miscarriage or a premature baby who died shortly after being born. "The threat to the world if the horrors of the air-atomic combination are ever unleashed," says Gen. Carl Spaatz, "is impossible to exaggerate." No one knows how many people could endure such horrors.

BLACKETT SAYS: "The number of atomic bombs required to produce decisive results in a war between America and Russia would run into thousands."

LAPP SAYS: "A properly prepared and alerted country can absorb not a huge but a fair number of A-bombs."

Blackett's conclusion rests on his contentions that an atomic bomb is the equivalent of only 3,000 tons of T.N.T., that other bombs were not decisive in Germany, that more would be needed against a bigger country, and that people would "take" atomic punishment. But what if things happened fast?

"One might as well argue," Dr. Manuel Sandoval Vallarta has written in *Physics Today,* "that because the kinetic energy of a certain rifle bullet is equivalent to ten body blows delivered by an expert boxer there is no essential difference between the effects of the bullet and the result of blows. Such reasoning is fallacious and, in the circumstances, highly dangerous."

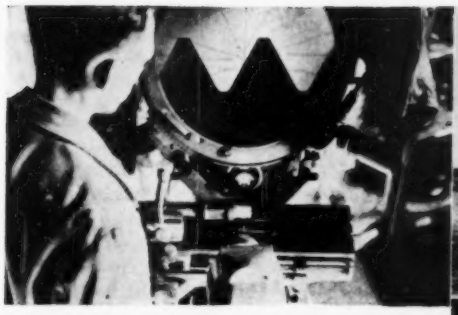
Lapp's conclusion is based on his belief that cities can be spread out, shelters provided, and measures taken to reduce the casualties from atomic attacks.

Maj. Gen. William E. Kepner has pointed out, however, that A-bombs haven't been tried yet in every conceivable way. Suppose, he has suggested, that one bomb were detonated in water, and that another were detonated a trifle later amidst the millions of tons of contaminated water thrown high into the air by the first bomb. Might not some such tactics make even the results of the second Bikini test seem piddling? Does anyone really know how many blows of that sort even a properly prepared and alerted country could absorb?

THE USSBS SAYS: "The best way to win a war is to prevent it from occurring."

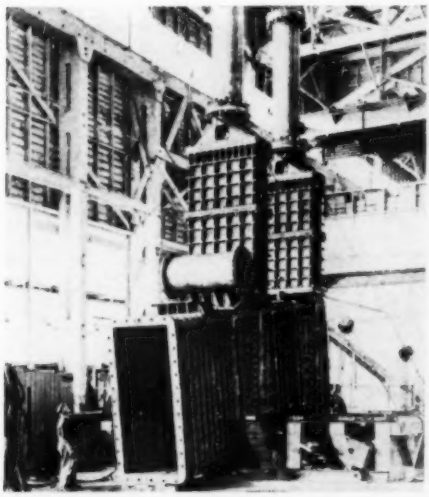
END

Aerial view of Nagasaki after A-bombing shows destruction two to three miles from the blast.



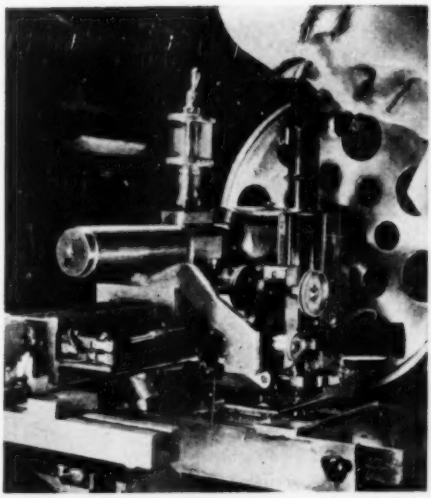
Projector Checks Threads

THE saw-toothed image on the circular screen above is a magnified projection of threading on a steel rod. The projector is used by U. S. Steel to spot defects that would weaken links between the sucker rods that actuate pumps at the bottom of oil wells. The cutaway view at right shows how a string of these rods connects a sub-surface pump with its engine hundreds of feet above. The slimmer the rods can be without breaking, the less they block the flow of oil.



Water Tap Weighs 100 Tons

THIS 47½-ft. structure is one of 16 slide gates that will control the flow of water through Bull Shoals Dam in Arkansas. Hydraulic pistons at the top raise and lower two five-ton gates across the 4- by 12-ft. conduit. Knocked down for shipment from the Westinghouse plant at Sunnyvale, Calif., the 100-ton unit occupied three railway flatcars.



10,000 Lines Cut to Inch

THIS machine is probably the world's finest engraving tool. Its diamond tip, guided by an operator who looks through a microscope, can scratch 10,000 lines to an inch on smooth metal. General Motors uses it to rule gold blocks that serve as comparison standards for surface finishes on bearings and other mechanical sliding parts.

Topped by his famous gray Homburg, Bill Odom shows what the well-dressed pilot wears on a record-breaking flight across an ocean and a continent. The plane is a Beechcraft Bonanza®.

How to Hop

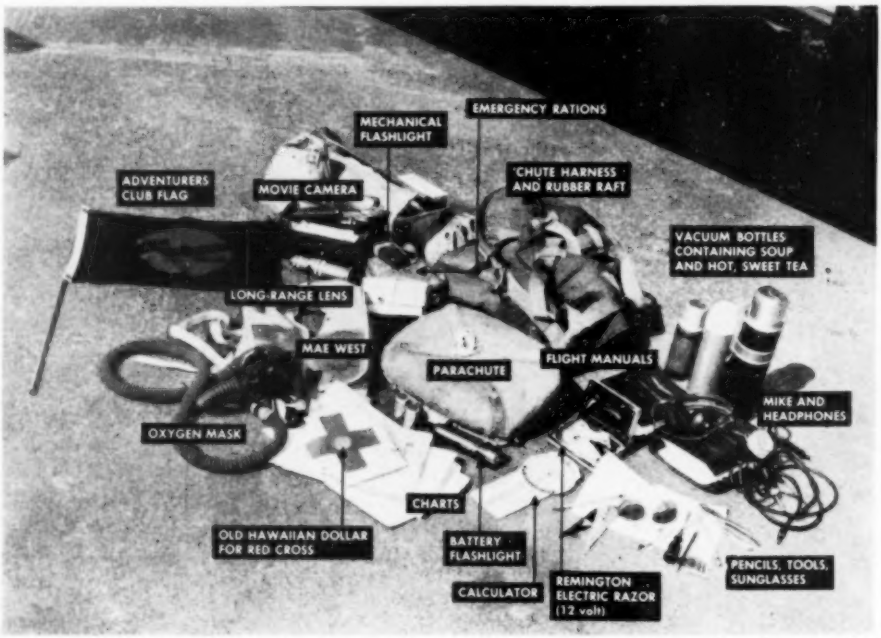
By Herbert Johansen

YOUR plane is a small, light, single-engine job—like the Beechcraft Bonanza® Bill Odom recently flew 5,300 miles nonstop from Hawaii to Teterboro, N. J., across the Hudson from New York City.

It's nice to have a sponsor, but be sure to check your bank balance to see that it will stand a nick of $90 for gas and oil.

It also helps if you can supervise the construction of the 185-hp., six-cylinder Continental engine as Odom did. It gives you added confidence in the compact power package that must keep you flying for 36 hours over ocean, mountains, and plains.

Patience is as necessary as extra gasoline and special flight instruments. Flying conditions must be just right. So you wait, day after day, haunting the weather office. While waiting, you supervise the assembly of your plane, and get plenty of rest, going to bed



It took a lot of planning and elimination to get the accessory equipment down to a minimum. About the only concession to personal comfort is the electric razor that plugs into the plane's cigarette lighter. Life raft and emergency rations are attached to 'chute in center.

5,000 Miles Nonstop

at 8:30 and sleeping until 9 a.m. Then, one day, comes the phone call from the weatherman. This is it. You rush to the airfield.

Your gasoline already has been chilled by a steel tube filled with dry ice inserted in the fuel truck. In six hours it has brought the temperature down from 80° to 20° F., shrinking it so that you can squeeze in 12 extra gallons—and, boy, how you are going to need them. With 288 gallons in wingtip and cabin tanks you take off. Out over the Pacific you're grateful for the one-man life raft and emergency rations—just in case.

In taking off you use full engine power because the plane carries a 50 percent overload; but at about 5,000 feet you throttle her down, using from 80 to 115 hp., depending on winds and weather. In the same way, you regulate your speed, from a maximum of 124-m.p.h. indicated air speed to a minimum of 110 m.p.h. It has all been figured to stretch that limited gas supply.

What with flying the plane, working the radio, and navigating, you're pretty busy. But you find time to eat—chicken sandwiches, chocolate, and bouillon. You drink orange juice, hot tea, and water—a diet calculated to keep you awake and alert.

About 450 miles out of San Francisco you're met by a PBM flying boat that escorts you to the California coast. You've made the mainland, and head north for Cheyenne. Bad weather, icing and snow, force you up to 16,000 feet and oxygen. But you get through and slide down the home stretch. Across the Midwest, your second dawn greets you over the Mississippi. Gas is holding out, but you feed it sparingly into that faithful, humming engine. Before you know it, there is the Hudson River—New York—and so you've more than doubled the world's light-plane record. That's how Odom did it—with 15 gallons, 3 quarts, and 1 ounce of gas left. END

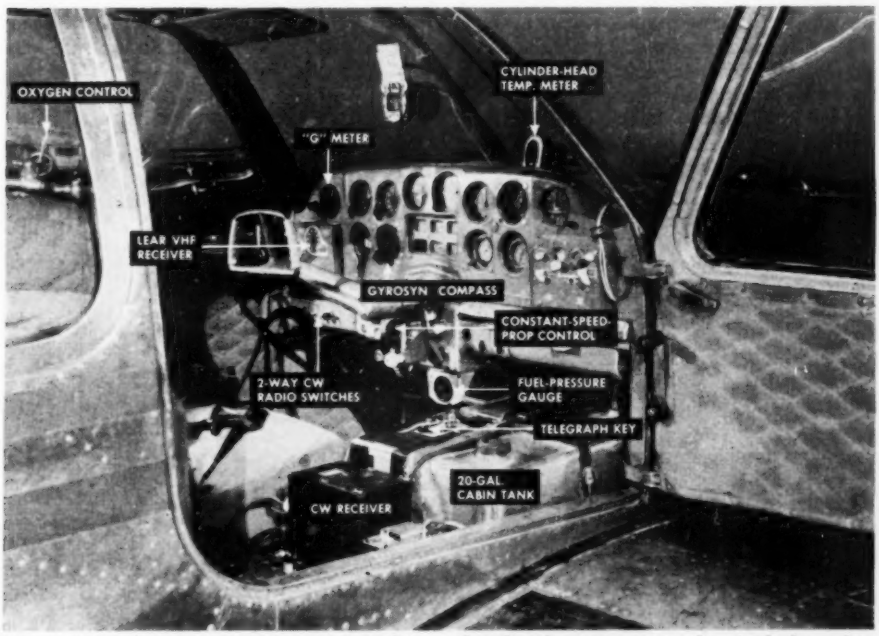
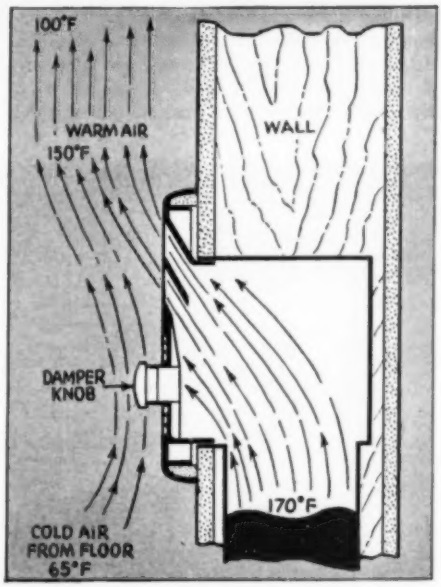


Photo above shows extra equipment carried in Odom's plane, the *Waikiki Beech*. Craft is four-place plane, but rear seats have been replaced with reserve gas tanks. Aside from this, and two 62-gal. wingtip tanks, plane is standard model. *PS photos by Hubert Luckett.*

New Unit Heats Homes Better for Less Money

WITH smart design and unconventional materials, General Electric engineers have turned out a new heating plant that provides more uniform, draft-free warmth at lower cost than old-style systems. A complete hot-air system, it uses 4-in. stovepipe that fits between the inner and outer walls instead of the more expensive rectangular ducts that require special cutting. The plenum chamber (above, right) has scored sections easily punched out for connections at any point. These short-cuts, says GE, reduce installation costs up to 50 percent.

The new unit supplies air at slightly higher temperature and much higher velocity than existing systems. A specially designed register (right) shoots this hot, fast air up so that it fans over the wall, warming the cold plaster to give even heating as in radiant systems. No air flow can be felt beyond a few inches from the wall, so furniture can be placed in front of the register itself. The package heating system is designed for use with oil or gas furnaces.

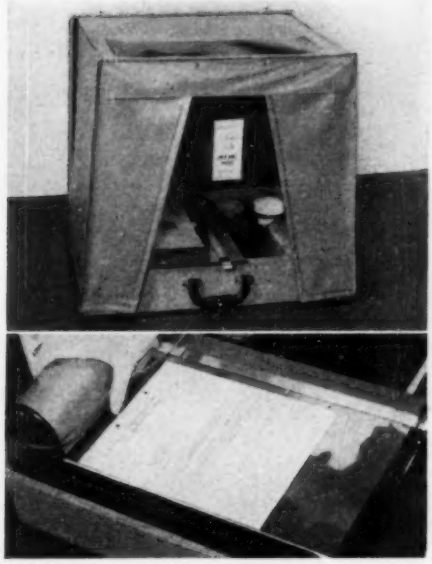


Ice Improves Concrete Block

ICE makes a new kind of concrete block lighter, yet stronger. The ice, mixed with the concrete, melts after the blocks are cast, leaving vacuum cavities (left) that add strength, cut weight, and increase insulation. The water from the melting ice is absorbed by the concrete, prolonging its drying time and so making it harder. W. R. Twiford, Miami, Fla., developed the process.

Robot Takes Phone Messages

IF YOU'RE away when your phone rings, this device will take the message by recording it on magnetic wire. At the second ring, it plays a record saying you're out, then begins recording your caller's message up to 60 minutes long. It shuts off when the caller hangs up. Called the Tele-Magnet®, its price is under $200.

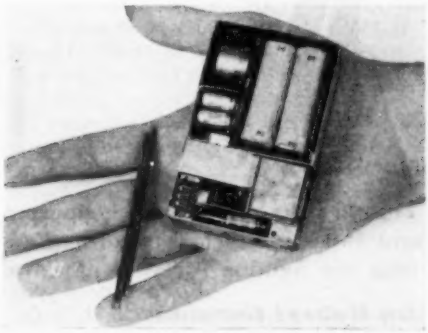


Darkroom Fits Suitcase

SET up this Copy-Roll® on its slim case (top) and you can make 30 photocopies an hour of a legal-size sheet. To print, put original against sensitized paper and roll them with transparent plastic tube (lower picture) enclosing light bulbs. Developer, fixer, and washing water are sponged on. Fairchild Aerial Surveys makes the kit.

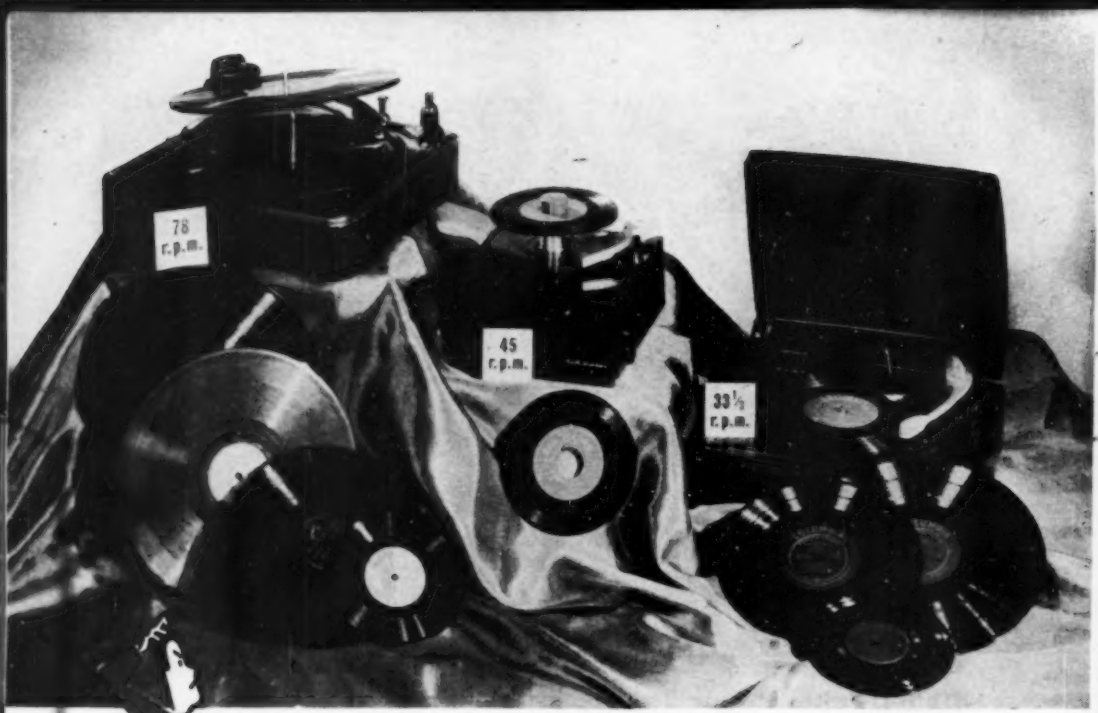
Recorder Is Miniature

THIS portable, 10-pound tape recorder, for on-the-spot pick-ups, can be carried by a shoulder strap. Called the Mini-Tape®, it measures only 6 by 7 by 13 inches and has a self-contained power supply. Made by Stancil-Hoffman, it has a tiny microphone that can be worn on lapel or wrist.



Smallest Two-Way Radio

HERE'S a 200-yard-range two-way radio that fits all its parts—including the power supply—into an 11-ounce package you can hold in your palm. Its parts consist of plug-in units that can be easily replaced. Developed by the U. S. Army Signal Corps, the set has a 2-ft., collapsible antenna.



Here's the old and the new, with the different sizes of records available for each. Note big center hole on the RCA record in the middle.

What's What in the Platter Battle

The old disks have been re-engineered, and two entirely new recording systems are fighting for your approval.

By Robert Gorman

WHEN RCA uncorked a new idea in phonograph records this spring—the industry's second big change since last summer—millions of U. S. phonograph owners found themselves with a tough question to answer. Shall I switch over to the new long-playing, 12-inch records, or to the even newer, small records put out by RCA?

It's a hard question, because either record requires also the purchase of a special attachment for the home phonograph. The devices are different—and not cheap.

The confusion facing the purchaser of records springs from attacks made on standard grooving by both Columbia and RCA. A conventional record is played on a turntable going at 78 r.p.m. The groove is wide. It has to be: the record must play on both the old acoustic phonographs and the newer electronic machines. The acoustic machine's arm may have a needle pressure of half a pound or more. The electronic pick-

up may put only ¾ of an ounce on the stylus. Groove characteristics have had to accommodate this variation.

Last summer Columbia popped on the market something brand new—a 12-inch platter that played not the standard five minutes, but a full 23 minutes. Big chunks of symphonic music could be reproduced without breaks. Columbia achieved this with tiny grooves—made possible by eliminating acoustic requirements—and by low speed. Instead of revolving at 78 r.p.m., the record turns at 33⅓.

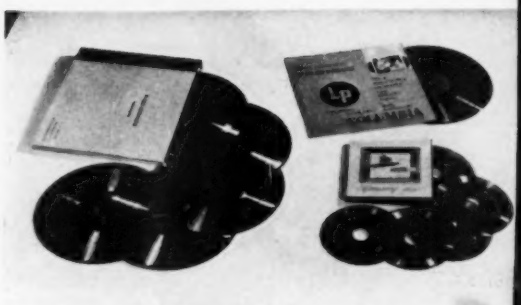
Now RCA has made its attack. It's different. Its special turntable spins at 45 r.p.m. Instead of a long-playing record, RCA has produced the equivalent of a 12-inch platter on a disk only 6⅞ inches in diameter. The company's low-speed records will be in this uniform size. Another innovation is a 1½-inch center hole to suit the records to a special high-speed changer.

Many reasons have been advanced for RCA's failure to follow Columbia's lead. One is that no one wants to listen to a solid 23 minutes of a single popular jingle. (Columbia has lately announced a 7-inch disk as well as the 10- and 12-inchers.) RCA engineers assert that 45 r.p.m. is the ideal speed, while their opposite numbers at Columbia say that 33⅓ is the best for getting the most good music in the least space. Both claim big advantages in record storage, though in different ways. Columbia points out that a single 12-inch disk takes the place of a whole album of 78-r.p.m. records. RCA counters by pointing out that its little records fit nicely in a bookshelf.

Both of the slow-play records offer a bonus advantage. They are pressed in unbreakable plastic and have much less surface noise than conventional shellac records. The plastic, which has been available at a premium price for some 78-r.p.m. records, is especially suited to the increased frequency range of the new systems.

The new records will sell for less. A single 12-inch long-playing classical record retails for about $4.85. It contains the musical equivalent of a four- or five-record album selling for $6 or more. The same amount of music (on four or five disks) on RCA records will cost $4.30 to $5.25.

Since there are an estimated 16 million old-style turntables in the country, and billions of records that can be played only on them, the change-over period will obviously be troublesome. Both Columbia and



Same music recorded three ways. At left is a conventional 78-r.p.m. album; at top right, a single Columbia Microgroove® disk of the same piece. Lower right shows the RCA disks needed.

RCA plan to continue to make 78-r.p.m. disks. Record players that will handle the old disks and one or both of the new ones are coming on the market.

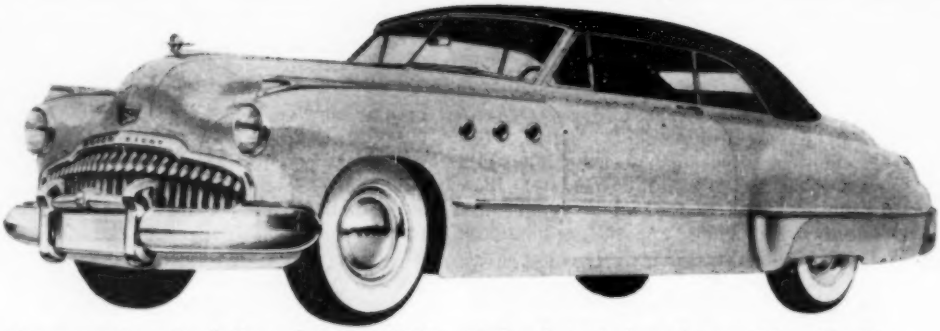
From a technical viewpoint, the change-over is long past due. Experts say that 78-r.p.m. recording has been obsolete for years. Established in the day of acoustic recording, this speed was needed to get even a minimum of fidelity scratched into and out of the shellac. The development of electronic recording and playback heads made possible fine recording, and reproduction at much lower speeds. A 78-r.p.m. disk delivers about three-quarters of a second of music on each spin. At 33⅓ r.p.m., a turn gives almost two seconds of music.

As important as speed is groove size. Industry standards established 25 years ago called for 85 to 98 lines per inch (depending on the amount of music to be squeezed on a side), and modern 78-r.p.m. records still range between 80 and 140 lines. In contrast, the new RCA records get up to 275 grooves to the inch, and Columbia's go as high as 300. Stylus pressure has been cut to a sixth of an ounce and tip diameter to .001 of an inch. This combination of light pressure and low speed promises greatly improved record life.

One thing a prospective buyer should ask himself is whether the rest of his equipment is up to the new records. Chances are it isn't, unless the amplifier and speaker are among the very best. In fact, many players now being sold especially for the new records don't really do justice to them.

So you pays your money and you takes your choice—and if you're smart you keeps your fingers crossed. END

Chevrolet Bel Air® is typical of the new GM hard-top "convertibles." Notice how the rear corners of the top come almost to V point, allowing the three-section rear window to curve forward. Top is painted to contrast with body. Lack of a door post gives open-air freedom.



For comparison, here's the real thing—a 1949 Buick Super Convertible®. When you see it, one distinguishing point will be the narrow-slit back window that cuts down the rear vision. Like the actual convertibles, the new hard-tops are swanky jobs for which you pay a higher price.

New Steel Tops Look

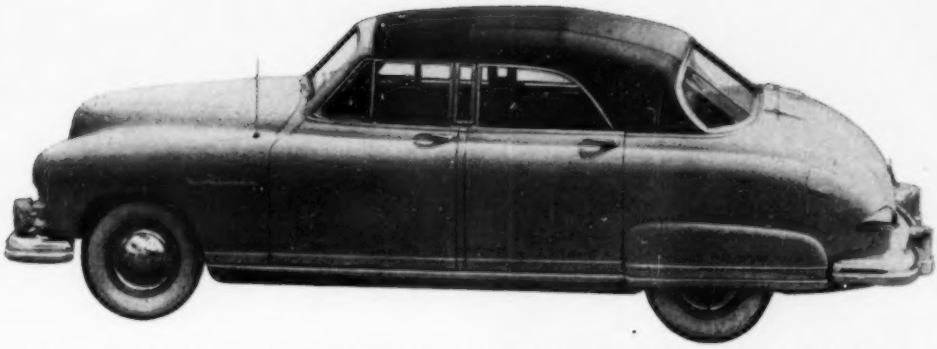
FOR motorists who like the looks of a convertible but are nervous under a tent on wheels, the automobile industry has an ingenious answer. It's a car that has the styling of a convertible but the sturdy, all-steel top of a standard model.

All divisions of General Motors are putting such a car into production this spring. Kaiser has been showing one for several months. In each case, the top is a sheet of heavy metal, stamped to shape, then reinforced and welded rigidly in place.

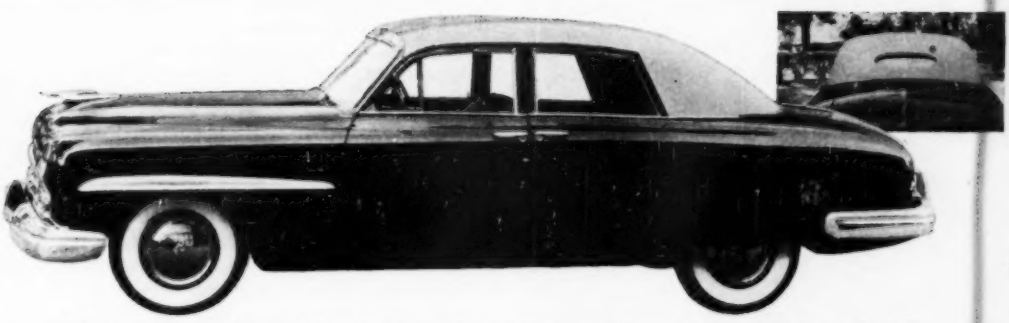
In styling, you must look sharp to tell the substitute from the real convertible. Kaiser uses a satiny nylon fabric and padding to conceal the metal top of its plushy new Virginian®. General Motors does the trick with enamel, different in tone from the body.

This trend harks back to earlier days. A top that looks, or is, different from the rest of the body has long been a sign of the ultra ultra. Padded fabric on a fixed top was a feature of a 1925 Studebaker. Currently, the Derham Custom Body Company in Rosemont, Pa., is filling a few dealer orders for a sporty fabric top bonded to the metal roof of the Lincoln Cosmopolitan® sedan.

All the new GM hard-top "convertibles"—



Kaiser Virginian® looks like true convertible, but under its nylon top is a rigid steel roof. Rear window measures 73 inches across. Narrow window between the doors is permanently fixed. The car closely resembles real Kaiser convertible. The delivered price is just short of $3,700.



Fabric top bonded to metal roof raises price of Lincoln Cosmopolitan® to more than $5,000. This is a custom job, done by the Derham Body Company only on order of dealers. Ford Co. itself has not joined hard-top trend. Oval rear window gives privacy, but limits vision.

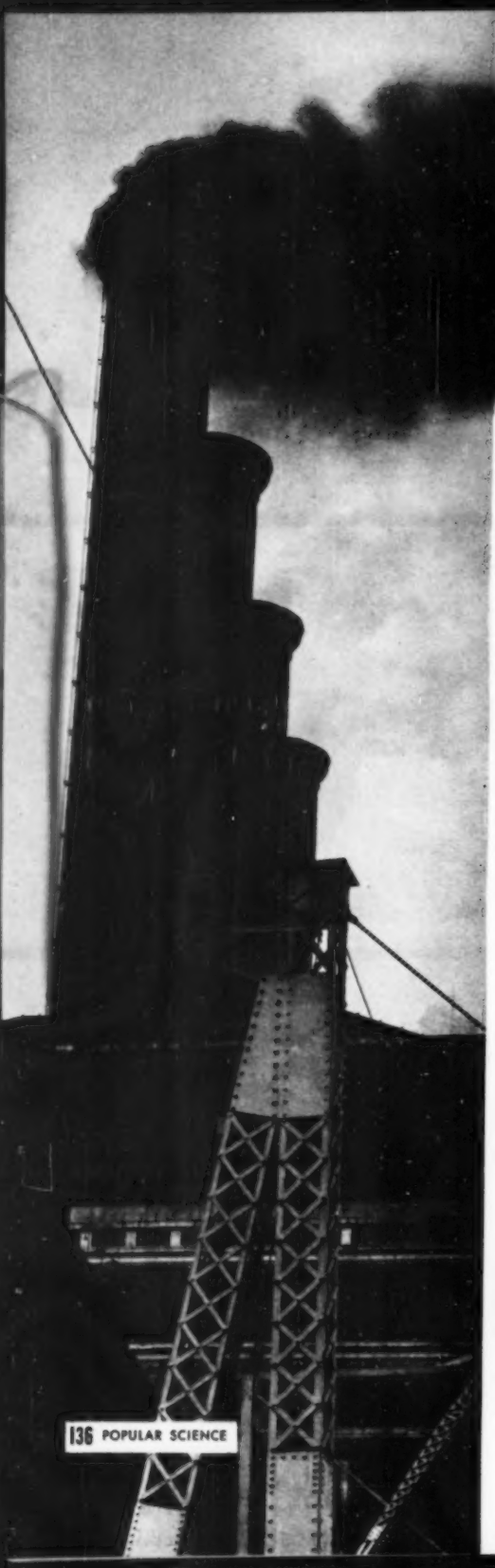
Convertible

Cadillac Coupe de Ville®, Oldsmobile Holiday Coupe®, Buick Riviera®, Pontiac Catalina®, and Chevrolet Bel Air®—are two-door jobs with a rear seat. The Kaiser Virginian® is a four-door model.

Center door posts are omitted in the GM cars. Rear quarter windows, rising from the body, fit closely against those in the doors. With the windows open, there's a clear sweep from front to rear, giving in part the open-air freedom of a true convertible.

In all GM models except Cadillac, the metal top comes almost to a V at each rear corner. End sections of the three-part, forward-sloping rear windows curve around the hitherto blind corners. Cadillac and Kaiser rear windows are also curved, but don't extend as far around. END

Forerunner of the new fixed "convertible" top was found on this 1925 Studebaker Special-Six Duplex Phaeton®. It had padded cloth over wood. Note large window area at the rear.



Must We

No—not when science

By George H. Waltz, Jr.

SMOKE costs Americans more than five billion dollars a year. If the smoking chimney could be completely eliminated, you as an average city dweller or suburbanite would save at least $20 a year on your own personal laundry and cleaning bills. Your fuel bill would be pared down a fifth. Your wife's household cleaning chores would be cut in half (smoke adds about 10 pounds of dirt to the average house every month). Your house would need repainting only a third as often. And you and your family would have to suffer through only about half as many colds and respiratory ailments as you now do.

Smoke is not only dangerous and expensive—it is unnecessary. It can be eliminated

If annual "smoke fall" in the U. S. were spread evenly over New York City streets, it would form layer 21 feet deep. In 50 years, it would cover 101-story Empire State Building.

Suffer Smoke?

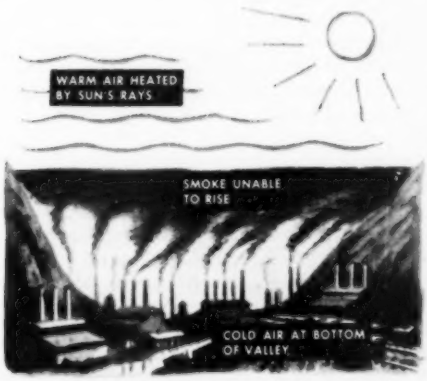
has given us a dozen ways to get rid of it.

easily at the source. It can be laundered with water. It can be dry-cleaned with electricity. It can be de-sooted with sound waves. It can be dispelled with giant "smoke guns." Science has provided at least a dozen ingenious ways to get rid of smoke and, in many cases, the smoke-eliminating or cleaning equipment pays for itself within a year by salvaging valuable by-products that normally go up the flue.

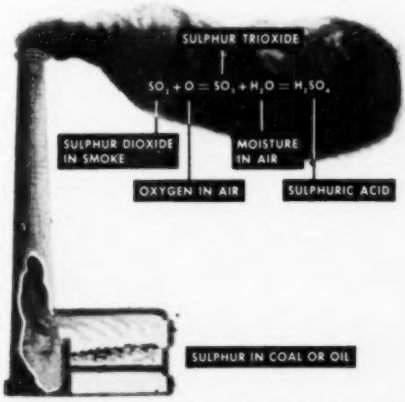
A few years ago, the owner of a large West Coast smelting plant was finally forced by his neighbors to do something about the clouds of soot and grime that his stacks were spewing over the California countryside. Reluctantly he spent $50,000 for special equipment to clean his smoke by removing the solids it contained. At first it seemed like an expensive process. But each year now he happily retrieves an average of 4,680 barrels of lead oxide from his flues—and sells it for a neat $93,600!

The smoke cleaner used in this particular installation is of the settling-chamber type, one of the simplest. The smoke on its way to the stack enters a large chamber fitted with baffles. As the smoke follows its winding course through this back-and-forth maze, its velocity is slowed to a point where it can no longer carry the heavier solid particles along with it. The particles then settle out and fall to the bottom of the chamber where they can be collected.

The most ingenious and effective method for cleaning up industrial chimney exhaust uses electricity and literally shocks the soot out of the smoke. This type of smoke cleaner, known as a Cottrell precipitator, can be



Drawing above shows how "lid" of smoke often forms over industrial town in valley. When earth is colder than upper air, lower air cannot rise, and smoke is trapped close to the ground.



Deadly sulphuric acid gets into air when sulphur in coal or oil burns, giving off sulphur dioxide. This plus more oxygen then forms trioxide, which reacts with moisture to form acid.

fitted directly into the flue system of a large industrial smokestack. When the smoke enters the precipitator, metal plates negatively charged with electricity give the solid particles a negative charge. As the charged particles then pass over another series of plates that are positively charged, the negative particles are attracted to the positive plates and cling to them until collected.

The Cottrell precipitator, named after its inventor, Frederick Gardner Cottrell, is widely used by industry not only to clean smoke but to retrieve valuable by-products. Large public-utility companies are among the biggest users. In dry-cleaning their smoke with electricity they salvage fly ash that they then sell to light-metal foundries, which use it in making their molds. Building-block manufacturers, who find the ash an excellent ingredient of their mix, are also customers.

Thanks to Cottrell precipitators, more than one manufacturer of cement not only eliminates his smoke problem but reclaims cement particles and chemicals that otherwise would be wasted. During the war, one manufacturer actually made more out of the potash he salvaged from his chimneys than he did out of the cement he produced.

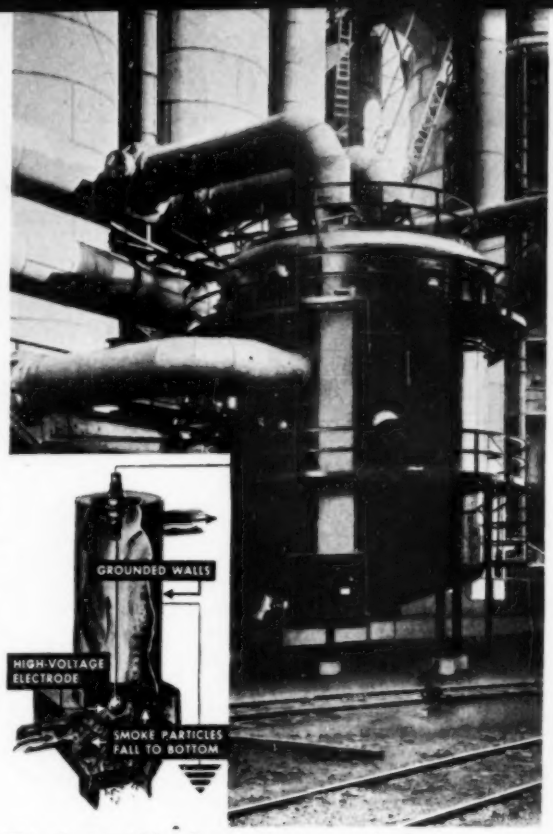
Soot "Hears" What You Can't

Newest of the smoke-cleaning methods makes use of sounds so high-pitched that they are inaudible to the human ear. Just as the electrical precipitator shocks the soot out of the smoke, the high-frequency sound waves literally shake it out. The system, still in the experimental stage, consists of allowing the smoke to enter a chamber containing a sound-wave generator. As the high-frequency waves course up through the smoke, they cause the solid particles, no matter how microscopic, to cluster together or "ball up." Their combined weight then makes them precipitate out and fall to the bottom of the chamber. The method is similar to that being tried for dispersing fog at airports (PS, Feb. '48, p. 135).

Nor are these the only smoke killers. Water sprays, thermal precipitators, and centrifugal precipitators also do effective jobs.

In the water-spray system, the smoke is literally washed clean. The water carries away the solid particles while the remaining gases pass up the flue.

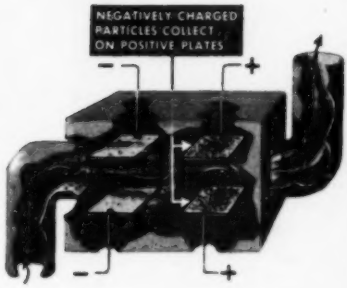
Thermal precipitation, on the other hand, makes use of the same old law of physics that causes the troublesome black streaks



This electrical blast-furnace precipitator shocks soot loose. High-voltage electrode in center (inset) charges particles, which then move to grounded walls, lose charge, and fall back.

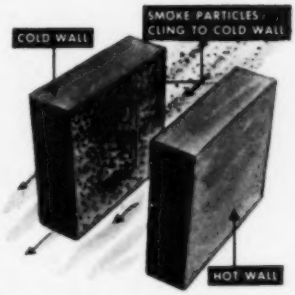
and weblike dust that form on the walls behind your radiators. Soot and grime, circulated by the rising heat from the radiator, hit the wall, which is cooler than the air, and are precipitated onto it. In a similar way, particles in smoke passing through a thermal precipitator, which consists of one heated wall and one cooled wall, are precipitated onto the cooled wall.

In a centrifugal precipitator, the smoke is whirled so violently that the solid particles in it are thrown out, just as the water is removed from sodden clothing in the conventional home-laundry spin drier. One type of centrifugal precipitator is now being tested on the stacks of steam locomotives. If it proves successful, it will go a long way toward solving the smoke problems in localities near large railroads and railroad yards. In railroad cities, like Chicago, it has been estimated that at least 15 of the 70 tons of smoke dirt that fall on each square



In plate-type electrostatic precipitator, smoke particles are charged by negative plates, then trapped by positive plates.

Water-spray cleaner uses high-pressure jets of water to wash solid particles out of smoke, letting only gases pass.



In condensation method, particles passing between two walls are heated by hot wall, then caught on cold one.

Mazelike settling chambers slow smoke's speed until it can no longer carry heavy solid particles, which then fall out.

High-frequency sound waves in this system shake soot out. Particles cluster, fall to bottom of chamber by own weight.

In dust chamber, whirling cloud of fine clay or silica-gel particles absorbs acids and other harmful smoke liquids.

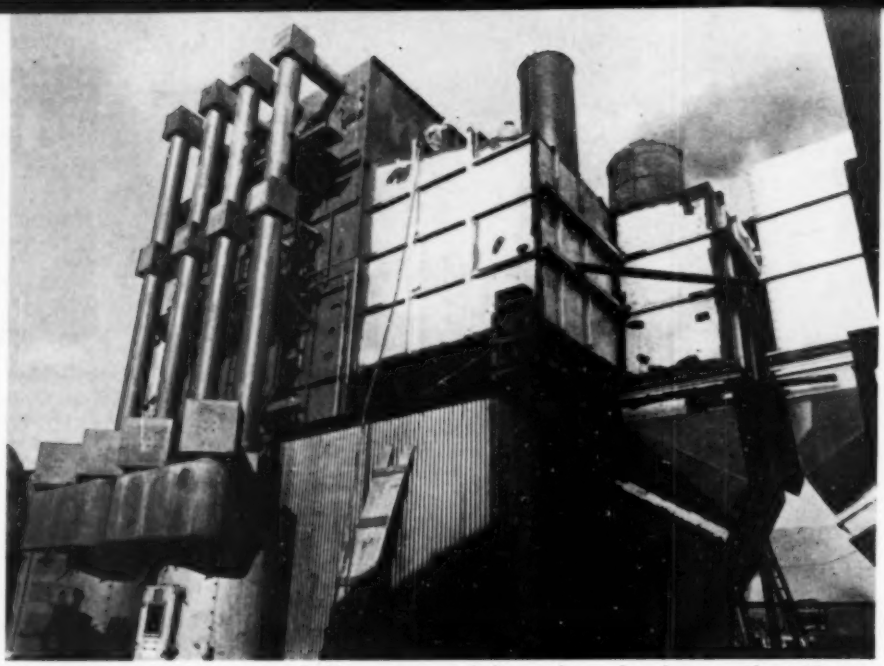
mile every month come from the smoking stacks of steam locomotives.

Smoke, depending on its source, can contain a variety of dirt and chemicals, ranging from simple unburned carbon to sulphuric acid, formaldehyde, and highly toxic fluorine—even phosgene, deadly poison gas of World War I. Every cubic foot of city air in the winter contains about 3,000,000 particles of solid matter plus assorted liquids and gases.

Fortunately, if a high percentage of the solid matter is successfully removed from smoke, a considerable portion of the liquids is also removed. Like the water droplets in the atmosphere that accumulate on dust particles to form fog, the liquids in smoke tend to collect on the solids. Thus the liquids are removed along with the solids.

In cases, however, where smoke is known to have a high concentration of sulphuric acid or some similar highly corrosive liquid, Dr. H. P. Meissner and Dr. H. S. Mickley of the Massachusetts Institute of Technology suggest the use of a novel filter in the form of a whirling cloud of dust. In their system, smoke, or exhaust from a chemical process, is piped into a chamber housing a continuously whirling mass of powdered clay or silica gel. Acting like tiny sponges, the dust particles soak up the liquids in the smoke before it is expelled into the air. In actual operation in a factory flue system, a small side stream of the used dust will be removed as fresh material is added to form a continuous filter.

Basically, a major portion of our over-all smoke problem, however, can be solved merely by the right choice of fuel combined with the careful firing of furnaces used for heat and power. That's how St. Louis, long dogged with an average of more than 100 hours of black smog a year, cleaned up its air. A law was passed—and enforced—re-



Electrostatic precipitator on roof of large central-heating plant in St. Louis removes fine fly ash from exhausted coal gases. About 150 tons of the ash are collected in this way every day.

quiring householders as well as industry to use either an easy-burning fuel, like hard coal, gas, or oil, or improved furnaces and firing methods to insure complete combustion of the smoky soft coal widely used in the region. St. Louis' smog seldom shows up these days. When it does, it generally is blown over from some nearby industrial town. Pittsburghers, using similar methods, now see 39 percent more sun than they used to see.

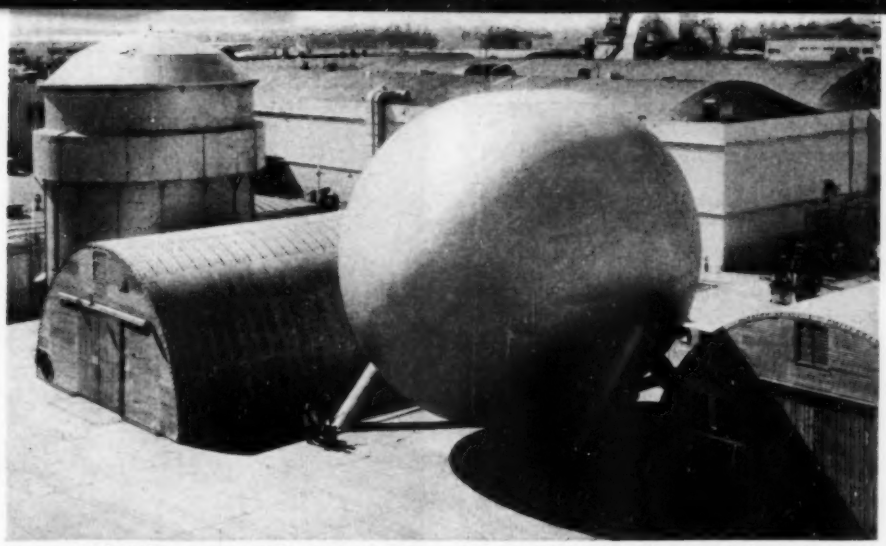
In Los Angeles, where eye-smarting smogs are held over the city by temperature inversions, experts have devised a "smog index" that allows them to forecast smog conditions accurately so they can then warn industrial plants in the neighborhood to limit the amount of contamination discharged into the air. A special smog chamber also allows them to reproduce smog conditions for tests.

One of the most unusual plans for getting rid of unwanted industrial smoke has been suggested by Dr. Phillips Thomas of the Westinghouse Electric Corp. His method consists of shooting slugs of smoke skyward at high speed from giant "vortex guns." Dr. Thomas' vortex gun consists of a drumlike chamber having a diaphragm at the bottom and a hole at the top, like a larger version of the device used to blow smoke rings in the famous Camel cigarette sign (PS, Jan. '47, p. 99). The chamber would be filled periodically with the smoke from an industrial plant. Then the diaphragm would be jolted upward by an explosive charge to send a giant smoke ring skyward.

With a sufficiently powerful gun, Dr. Thomas estimates, it would be possible to shoot such smoke rings up at a speed of 1,000 m.p.h. to an altitude of a mile or more. At that height, they would be dispersed and blown harmlessly away by the strong upper winds! END

Meteors Give Siberia One-Two Punch

A METEORITE that fell in eastern Siberia in 1947 was probably one of the largest on record, according to a recent ground and aerial survey that estimates its weight as about 1,000 tons. Breaking into fragments high in the air, it struck with a noise heard more than 100 miles away, blasting craters up to 92 feet in diameter and 20 feet deep. Northern Siberia in 1908 was the target of a gigantic 40,000-ton meteorite. The meteorite that blasted out Meteor Crater in Arizona, probably thousands of years ago, has been variously estimated as 100 to 1,000 feet in diameter, indicating a weight of between 65,000 and 65,000,000 tons.



Pumps in building at far right suck air from 36,000-cubic-foot, spherelike chamber next to it, producing a vacuum. Dry air is stored in 48-foot-high steel tank at far left. In between is the test section in which the scale models are mounted for supersonic wind-tunnel tests.

Big Blow Is Vacuum-Made

WHIPPING up supersonic cyclones of 4,000 miles an hour is easy for the odd-looking wind tunnel above, recently completed at North American Aviation's Los Angeles plant (PS, Oct. '48, p. 118).

The new tunnel will undoubtedly be the birthplace of many guided missiles, rockets, and high-speed aircraft of tomorrow. In the blast of its airstream, more than five times faster than the speed of sound, engineers can test the aerodynamic characteristics of push-button weapons that our military airmen hope will defy detection and interception by an enemy. From it will come the know-how to build wings and fuselages with high lift and low drag, both essential to bodies moving at supersonic velocities.

The principle of the tunnel is simple. Its test section is located between an air-storage tank and a vacuum sphere. When a valve is opened, the vacuum chamber sucks dry air from a collapsible nylon balloon in the storage tank, pulling it through the test section at speeds from 900 to more than 4,000 miles an hour. The new California supersonic wind tunnel is patterned after the German Kochel tunnel being operated by the Naval Ordnance Laboratory at Silver Springs, Md. END

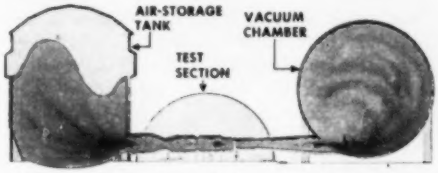
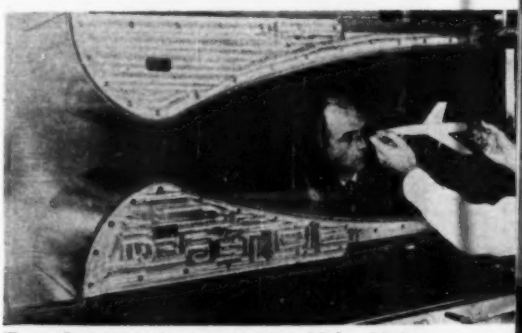
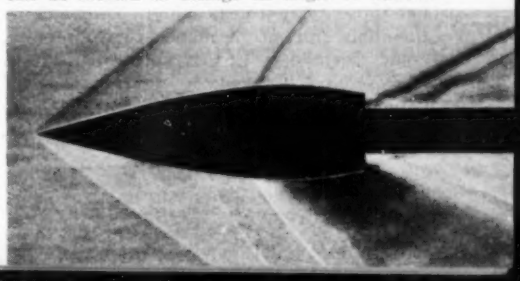


Diagram shows how air is sucked from storage tank, through test section, and into vacuum tank.



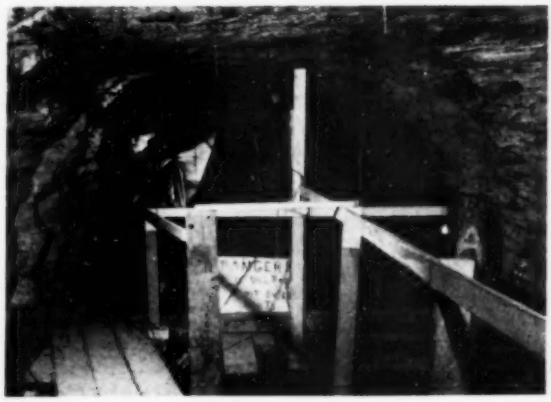
Tunnel test section, measuring 16 by 16 in., takes small-scale models of aircraft or airfoils. Its "throat" squeezes air, speeding it up so it whizzes past models at supersonic velocities.

Photograph below, taken during test, shows shock waves created by missile at simulated speed of 1,350 m.p.h. Model, held by wire, can be rotated to change its angle of attack.



Deep-Sea Automaton. Now sunken treasure may be sought at depths beyond reach of human divers with the strange undersea machine exhibited at right by its inventor, Hans von Schultz, in Dunen, Germany. Designed to salvage valuable cargoes from wrecks, the crewless automaton is maneuvered from the surface according to images transmitted by a built-in television camera, for which four powerful lamps provide illumination. By means of an electromagnet seen at lower left, the electric-powered, six-foot-diameter machine attaches itself to the hull of a derelict. Then the whole apparatus slowly rotates about the magnet shaft while an electric tool contained in the tube at right (above inventor's shoulder) cuts a circular hole for access. Finally, lowered through the opening it has made, the device grasps valuables with extensible tongs, holding them in a tight grip while it is hoisted to the surface.

Juiceless Lamps. Lighting up if shaken, these dumbbell-shaped bulbs use no electricity. Their glow, visible for half a mile, results from a reaction in a neon atmosphere between mercury and phosphors like those in fluorescent lamps. They last indefinitely and can be made in any shape or color. Inventor J. L. Cox, of the Duro Test Corp., North Bergen, N. J., sees uses on vehicles, lifeboats, and for stage effects.



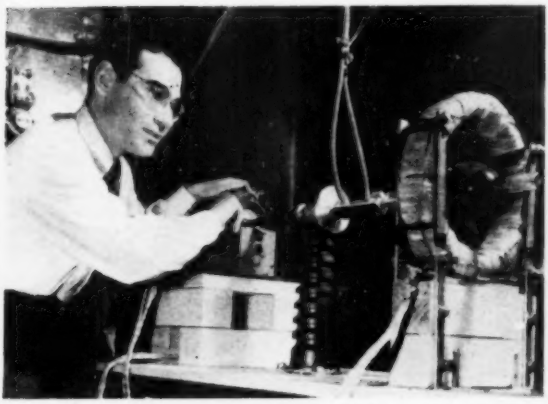
Tenting in a Tunnel. Seeking a site to study mesons, most powerful and mysterious of cosmic-ray particles, Cornell University scientists have pitched camp in this old water tunnel. Twenty-five feet of limestone overhead makes a natural filter to screen out all particles but these penetrating atomic fragments. The sign in foreground warns of the high voltage of electrical instruments housed in the tent.

Bacteria "Eat" Radioactivity. One of the most perplexing of atomic-age problems, how to get rid of radioactive by-products, may be solved by feeding them to germs. Small-scale trials have worked, and a pilot plant is projected to apply the novel idea.

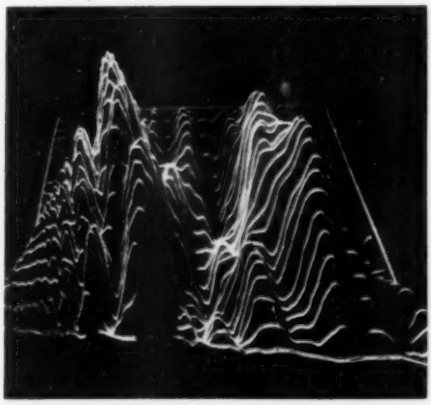
Since waste liquids containing products like plutonium will stay "hot" for centuries, storing them in costly subterranean tanks has been the only safe way to dispose of them. As time goes by and atom piles multiply, the problem will increase. There is no known way to destroy radioactivity. But any way of reducing the bulk of "hot" waste to be stored would be helpful. This is where the germs come in, according to a plan originated by C. C. Ruchhoft, U. S. Public Health Service chemist.

Now under study at Oak Ridge and Los Alamos atomic-energy plants, his idea is to pass waste liquids from atom piles through a gelatinous sludge containing massive colonies of bacteria. These germs will absorb and concentrate radioactive material in their cell membranes. Virtually freed of radioactivity, the purified liquid would then be safe to discharge into rivers.

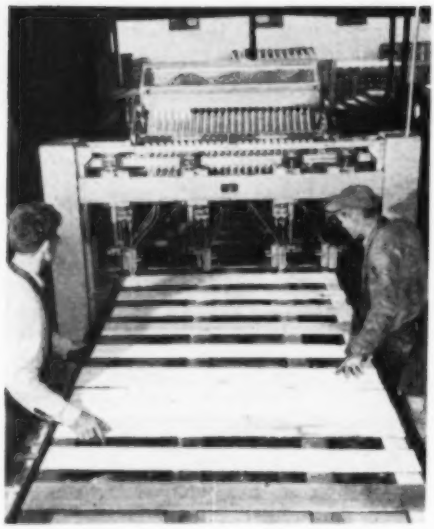
Tests at Los Alamos show more than 95 percent of plutonium is extracted from fluid passing once through the germ-laden sludge; a "two-stage" process should remove 99 percent, considered sufficient. The residual sludge containing the germs and the radioactivity can be dried and compressed 700 times into tiny pellets, as illustrated above, for underground storage. So long as the germs get enough artificial nourishment—normally they live on organic sewage—they will not be bothered by the radioactivity of their strange diet. Bacteria have been found to thrive under radiation hundreds of times as intense as that which kills a man.



X-Ray Tube Wobbles. To multiply the output of an X-ray tube without overheating the target plate inside, A. I. Berman, Stanford graduate student, devised the method shown above. A coil, right, develops a rotating magnetic field that swings the electron beam within the tube over the target plate, distributing the heat. An external motor gyrates the tube in synchronism, thus keeping the X rays at a fixed point of focus.



Electricity Pictured. Nearest thing to a portrait of an electric current, General Electric experts say, is this three-dimensional model of a simulated lightning stroke flowing through a copper coil. It is made of photos from oscillograph readings of the winding, mounted on fiber board. Height measures voltage peaks and valleys; width represents time; and distance lengthwise traces location of impulse in coil.



Multiple Hammer Nails Crates

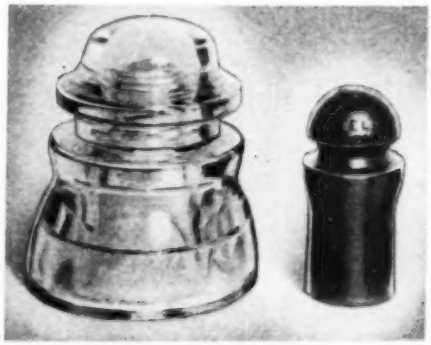
A MACHINE that stands 8 ft. high, weighs more than a ton, and has a 5-hp. motor is a lot of equipment just to hammer nails—but it can drive and clinch 24 at a time. It can turn out a completed crate section like the one above, which is 52 in. by 140 in., every 40 seconds. Food Machinery and Chemical Corp., Riverside, Calif., makes the hammer.

Materials Wriggle Uphill

LOOSE materials actually flow uphill on a new factory device that handles powders and small articles. High-speed vibration does the trick, making the material inch its way up the spiral ramp. The spiral does not turn, but is simply shaken by an electromagnetic drive. Syntron Co., of Homer City, Pa., makes the vibrating feeder.

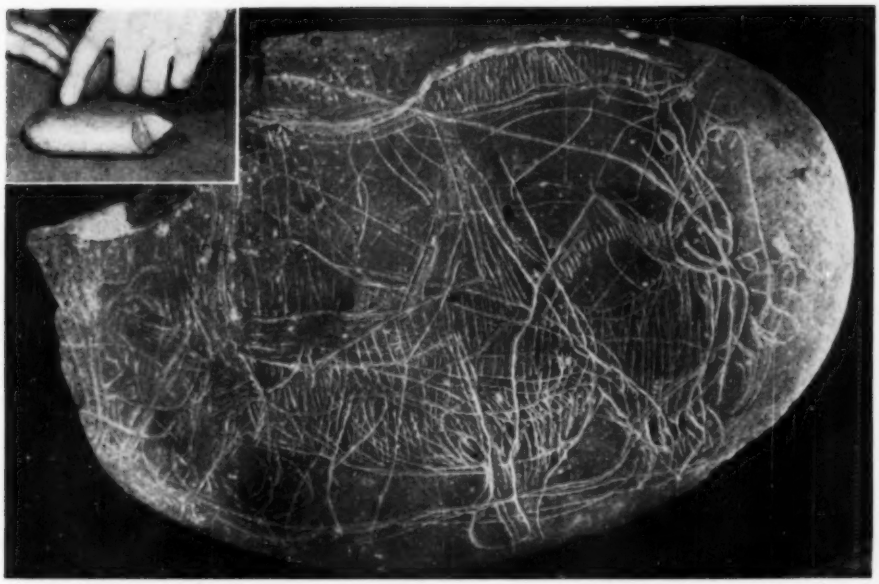
Tractor Rake Aids Haying

THIS new tractor rake that handles all kinds of crops quickly and cleanly also reduces damage to plants often caused by the tractor itself. Used with hay, it produces windrows that are loose and fluffy, thus helping to preserve the color. Made by Earthmaster Farm Equipment, Burbank, Calif., it mounts on the tractor's front.



New Insulator Is Boy-Proof

WESTERN UNION has finally gotten even with small boys. After long years of patiently replacing the glass telegraph-pole insulators (left) that the boys used for target practice, the wire company has developed a rubber insulator (right) that won't break. Extremely light, it is hard enough to do its job, but soft enough to let bullets and stones bounce off.



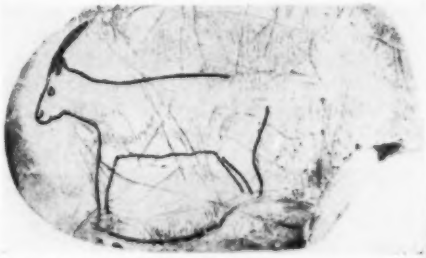
"La Colombiere Pebble" shown in inset and close-up photos depicts animals of prehistoric era in ancient carvings drawn on top of each other. Drawing of horse is most plainly seen.

Zoo Found Engraved On Pebble

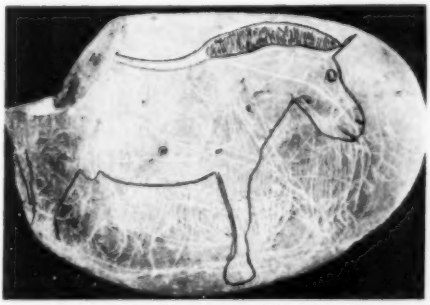
CARVED one on top of another, nearly a dozen wild beasts adorn a pebble about the size of a large potato, shown here. Called one of the finest engravings of its kind ever brought to light, the strange work of art was discovered last summer by Dr. Hallam L. Movius, Jr., Harvard University archaeologist, while excavating a hunting-camp site at La Colombiere in eastern France.

As Dr. Movius pieces together the pebble's story, it served the huntsmen as a good-luck charm. Before they set forth upon the chase, one of them carved on the pebble the likeness of the animal they hoped to bag. Evidently good fortune bolstered their faith in the "lucky" stone, and their artist frequently revised it to suit the occasion, with pictures that include a bison, horse, ibex, rhinoceros, and deer—all prehistoric.

For this happened, Dr. Movius figures, some 20,000 to 25,000 years ago. END



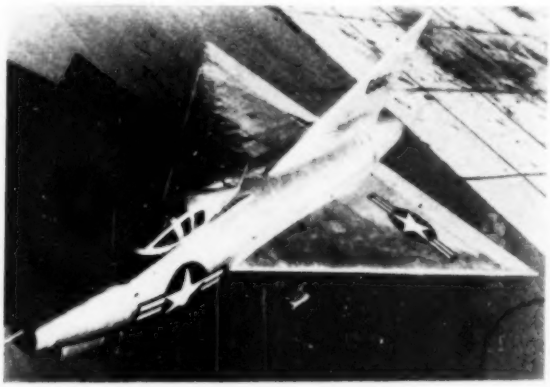
Artist's picture of an ibex is seen on same side of the pebble as the horse, when the stone is turned opposite way. Engraved outline has been filled in with black ink to make it stand out.



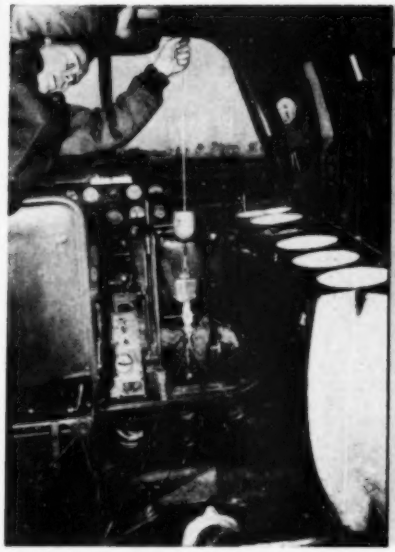
Ink treatment of outline of horse also gives better view of Stone-Age artist's handiwork. Pebble is believed to have served owners as a good-luck charm on prehistoric hunting trips.

Fuselage Flaps Flip. Diving in formation, these Navy AD Skyraiders, with all stops out, show what they have in the way of braking equipment. In a vertical dive at 500 m.p.h., the doorlike fuselage flaps will reduce speed by about 200 m.p.h. The array of brakes comes in handy both in combat maneuvers and in a diving approach on a target. Some 18 separate versions of the Douglas-built bomber are projected or in service. Skyraiders, now operational, carry a bomb-rocket load three times heavier than when the airplane was first introduced. One version, designed for tactical ground support, carries rockets, from five-inchers to 1,200-lb. Tiny Tims.

Loading a Heavyweight. Into the bomb bay of the giant B-36 Convair six-engine bomber goes a 42,000-pounder. Two of these bombs were carried on a recent mission and dropped on the Muroc Air Force Base bombing range in California. This 42-ton bomb load is claimed to be the heaviest ever carried by one plane.



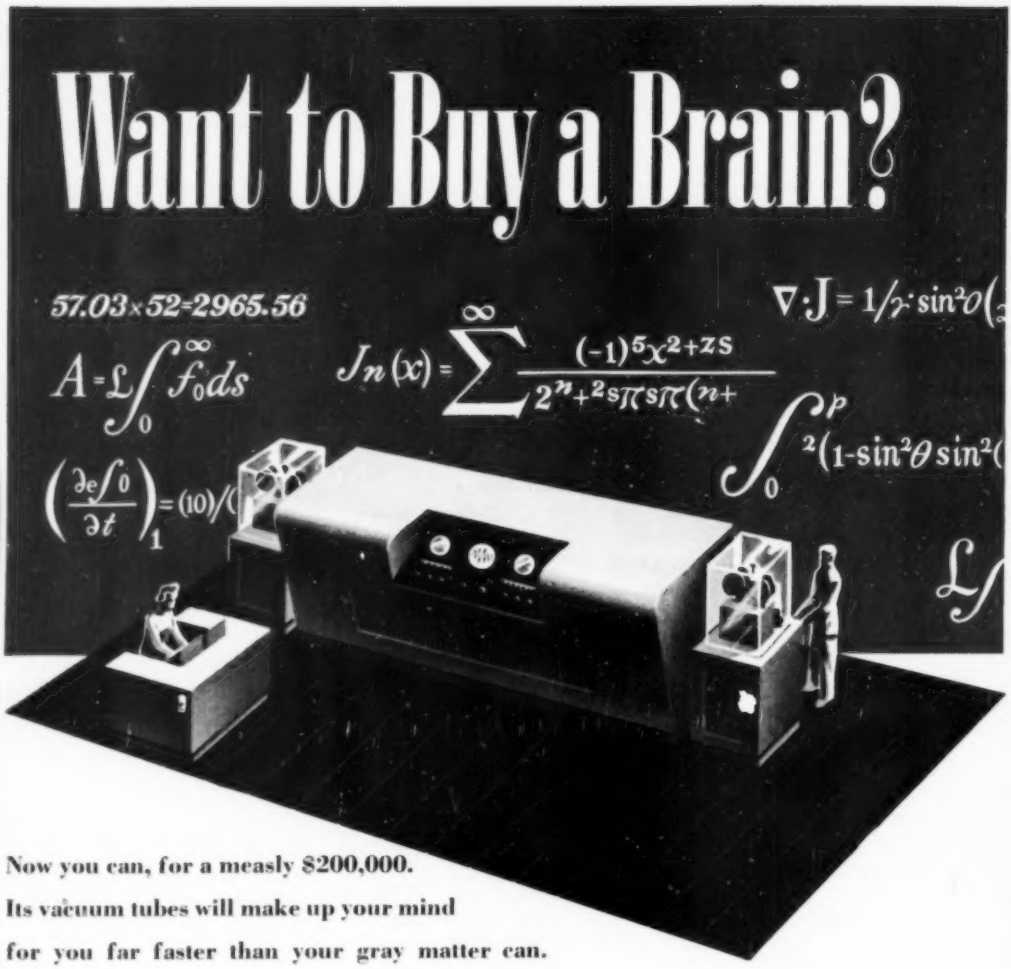
Air Force Adopts Arrowhead. With a 60° sweptback wing, the flying triangle shown above is the USAF's newest jet-powered research plane. The Model 7002, designed by Consolidated Vultee to test flying characteristics of the Delta Wing, has proved its efficiency in wind-tunnel tests at transonic and supersonic speeds.



'Copter Cuts Capers. Probably the first helicopter to perform a loop (inadvertently during a test flight), the Navy's new Piasecki XHJP-1, is designed for more serious assignments with the fleet. Hauling a litter patient aloft, as shown at right above during a simulated rescue mission, is one of its jobs. A hydraulically operated hoist, as shown at left, permits the litter to be brought directly into the cabin. The 'copter will also serve as a ship-to-ship and ship-to-shore personnel transport. With the blades folded, the XHJP-1 can be lowered even on the comparatively small aircraft elevator of a cruiser. The craft will carry five passengers or three litter patients.

Defense in the Air. This may be the Air Force's answer to any enemy bombers or missiles that may try to hit the U. S. homeland in a surprise attack. It is Republic's new XF-91 jet-powered interceptor-fighter, reputed to have a top speed equal to that of sound. Four rocket motors, mounted at the extreme tail of the plane, will give added power for take-offs and climbs and high-speed acceleration for high-altitude combat. Note the sweptback wing and horizontal and vertical tail surfaces. Landing gear consists of two wheels in tandem under each wing plus a conventional nose gear. Engine probably will be a GE J-47 with over 5,000 pounds' thrust.

Want to Buy a Brain?



Now you can, for a measly $200,000.

Its vacuum tubes will make up your mind

for you far faster than your gray matter can.

By Martin Mann

PS photos by Hubert Luckett

YOU can buy a machine now to do some of your thinking for you. It will give a definite answer to any question that can be expressed mathematically.

Ask one of these machines how thick the cables for a new bridge should be, and it will tell you.

Ask how fast a new automobile can go before its crankshaft starts to vibrate to pieces, and it will give the exact speed.

You can order one of these electronic brains from a number of organizations. They are being made by the Eckert-Mauchly Computer Corp., Raytheon Mfg. Co., Harvard, M.I.T., the University of Pennsylvania, and jointly by RCA and the Institute of Advanced Study.

One of the most versatile of the new machines will be the Univac® (for UNIVersal Automatic Computer), now under construction by Eckert-Mauchly. It will be much smaller than older computers, but will still take as much room as almost 70 people standing together. It will have 1,500 vacuum tubes and 12 seven-inch reels of magnetic tape. It will be able to multiply 10-digit numbers 30,000 times a minute, and solve hundreds of equations containing hundreds of unknown numbers all at one

time. It will work 6,000 times faster than a man with a desk adding machine. It will cost $200,000, somewhat less than Eniac's $400,000 (PS, April '46, p. 83) and the Harvard Mark I's $250,000 (PS, Oct. '44, p. 86).

The newest thinking machines have speeded up their counting by replacing the relays of older types with vacuum tubes, which also act as switches but work much faster. They also have bigger, quicker memories, and faster equipment for putting information in and getting answers out. By counting so fast, they are able to think. They can compute quickly enough to find an answer by logical mathematics, where the human brain, too slow to figure the problem out exactly, must rely on judgment.

Aeronautical engineers, for example, know how to calculate a plane of desired characteristics. And they do some of the figuring. But in the end, they give up the mathematics, make a good guess, and build a model. One model of a bomber might cost $30,000,000—and it could crash on the first flight. An electronic computer could portray the flight of a planned airplane *before it was even built*, possibly eliminating the need of any experimental models.

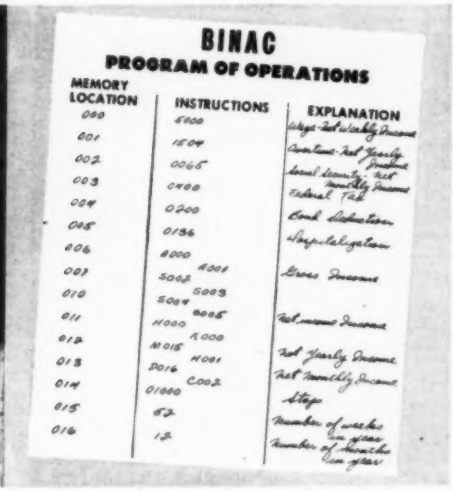
The first Univac, however, will tackle a less-dramatic job than flight-testing an airplane still unbuilt. The number-one Univac is being made for the Census Bureau, which will use it to compile useful information scattered through the millions of individual cards made up by the census takers.

Univac will be able to do this easily and quickly. All the information on all people—expressed as code numbers—would be run through Univac. The machine would classify the codes any way it was told to. Machines that feel holes in cards now do this, but they work comparatively slowly.

Four other Univacs are already on order. The Army Map Service wants one to change surveys from one system to another. The Air Comptroller wants one to compute the most economical way of handling supplies. And an insurance company and a market research organization have each ordered one to calculate their own statistics.

How do they work? Like children, these man-made office workers will count on their "fingers" (i.e., vacuum tubes) to add. They will count backward to subtract, and count repeatedly to multiply or divide.

Many primitive people count by two's (called a binary system), rather than by ten's. So will Univac. But decimal problems will be fed into it and decimal numbers will come out. Leaping from our decimal system to a two-number system and back again is



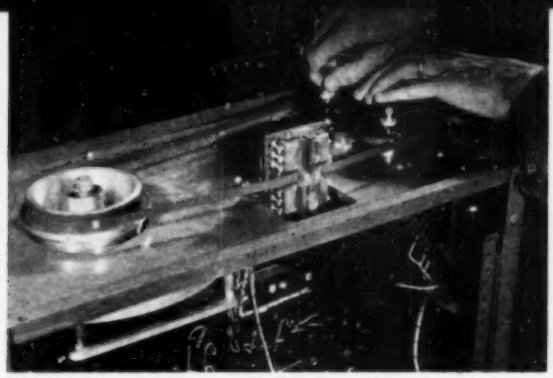
BINAC

PROGRAM OF OPERATIONS

MEMORY LOCATION	INSTRUCTIONS	EXPLANATION
000	5900	Stop-Set Weekly Income
001	1504	Operation-Set Yearly Income
002	0065	Local Income Tax Set Monthly Income
003	0400	Federal Tax
004	0200	Bank deduction
005	0136	Hospitalization
006	8000	
007	5005 H001	Gross Income
010	5004 5003	
011	H000 8005	Set income Income
012	N015 N000	
013	D016 H001	Set Yearly Income
014	01000 C002	Set Monthly Income
015	52	Stop
016	12	Number of weeks in year
		Number of months in year

Electronic computers can figure out hundreds of pay checks faster than the abacus did one for John Doe (PS, Aug. '48, p. 86). To show you how one works, mathematician Jean Bartik prepares the "program" that will present John Doe's pay check question to Binac®, the kid brother of Univac®. Binac needs this instruction sheet, or "program," to tell it how to find John Doe's weekly, monthly, and annual pay. The left column is an index, showing the machine where to look in its memory for a number or order. Next column gives numbers and orders.

The figures of John Doe's salary are punched on this keyboard and fed directly to the machine. Instructions and numbers referring to any like problem are also punched here, but fed to a magnetic tape for use with any employee's salary. Note that keyboard goes only to 7, since Binac must be given numbers in octal (8-number) instead of decimal (10-number) system.



This magnetic tape now holds basic figures and numbers for use with any pay-check problem. It feeds them to the computing part of Binac at the rate of about 1,000 per second. It also serves as an extra memory, storing intermediate information that will be needed later in the computation. Information can be held as long as needed, or erased to make room for new data.

really quite simple. Suppose, for instance, that you use 0 and X as your two numerals. Then let 0000 represent zero, 000X represent one, 00X0 represent two, and so on. Univac will do its computing by handling numbers in this way.

The reason binary numbers must be used is that a single vacuum-tube switch cannot represent 10 different conditions, but only two: it can be either on or off. If the tube is on, it represents the binary numeral X; off, it represents 0.

The tubes count by turning on or off in the proper sequence. They do this in response to a five-part electric signal, similar to telegraph code, that represents the number in binary numerals. The signal is made up of pulses and no pulses (blank spaces). The pulse corresponds to the binary numeral X, the blank space to 0. Thus the number two (00X0) would be blank, blank, pulse, blank. An additional pulse or blank space is also added to the signal as a check against mistakes.

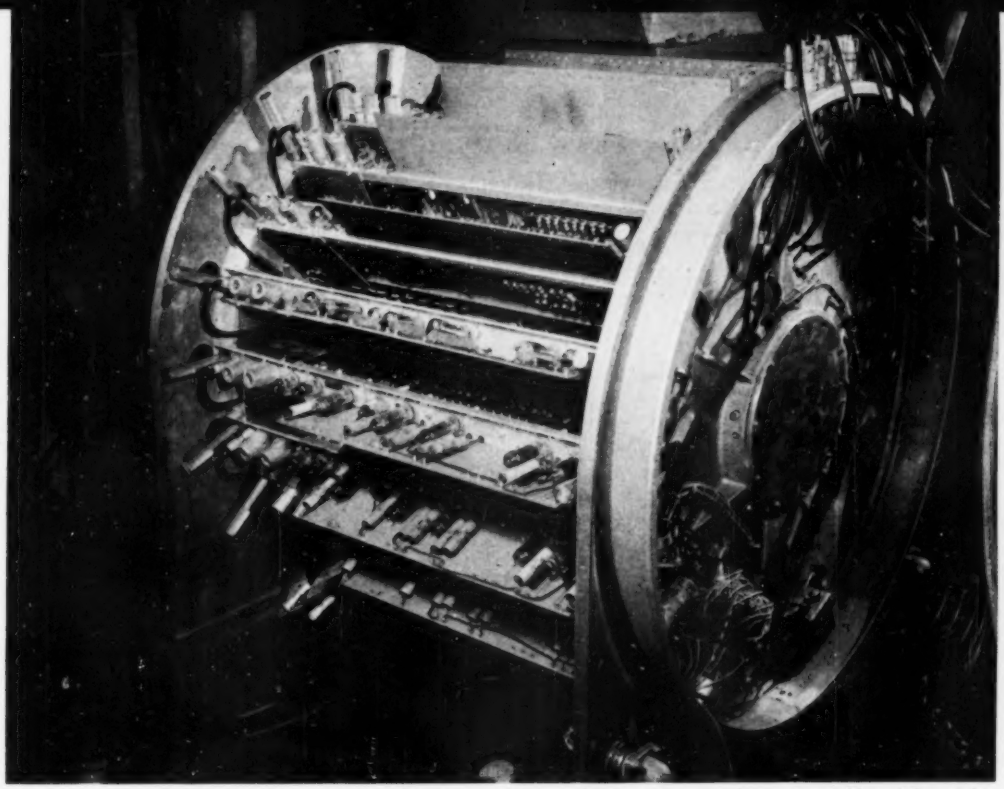
In Univac, these code groups are handled by "adder" units made up of "gate" tubes arranged in "and" and "or" circuits. The "adder" adds two numbers (each having four digits, remember) by taking the digits in pairs, one from each number. This is the same way you add big numbers. Thus, to add three (00XX) and six (0XX0), the adder first gets the sum of X and 0, then X and X, and so on (for an example—simplified slightly from the system actually used—see page 152).

Even the fanciest mathematical problems are done this way, since differentiation, integration, or any other complex calculation can be reduced to simple arithmetic. Only one small set of vacuum tubes will be used for actual computation, and it will perform only a single operation at a time. It will work so fast, however, that the rest of the machine will have trouble keeping up.

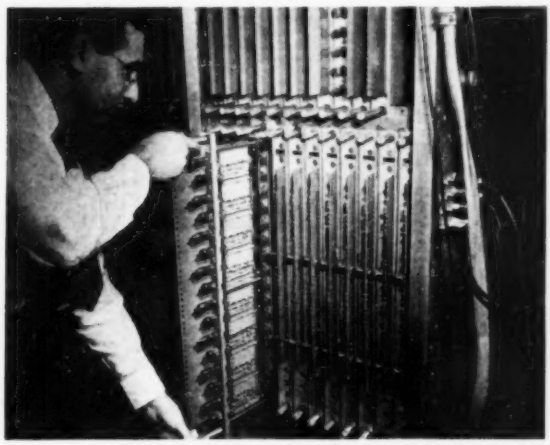
The signals giving Univac its figures and instructions will come from a typewriter-like keyboard. Since the machine must keep some of them in mind, the way you do when you work a problem, it has a memory.

And like you, it really has two kinds of memory. One kind is high-speed, for remembering things that will be used quickly and then forgotten, the way you carry figures in your head when adding. Univac's high-speed memory will be a tank of liquid mercury metal—the stuff used in good thermometers—that stores up the numbers. Signals representing numbers will travel to a quartz crystal at one end of the mercury tank. The crystal will vibrate, creating a sound signal in the mercury duplicating the electric signal. A second crystal at the other end of the tank will pick up the sound signal, convert it back into electricity, and send it around to the first crystal again. Since sound travels much slower than electricity, many signals (i.e., numbers) can be kept circling through the tank indefinitely, and any one can be picked out of the electrical part of the circle whenever needed.

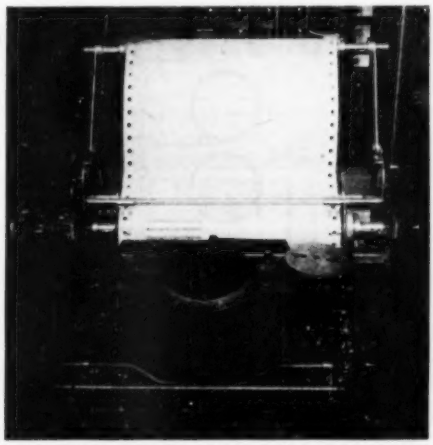
Univac has a slow memory, too—something like a scratch pad for noting intermediate results. Univac's scratch-pad memory will be a magnetic-tape recorder. Figures



Before Binac does any actual figuring on John Doe's pay check, it sends all information to the memory—a tank of mercury in which the signals circulate until needed. Circular end-plate that closes mercury column is visible at far right. Binac has 16 memory circuits, each kept moving through mercury by its own set of vacuum tubes (sticking out like spokes in center of photo).



These vacuum tubes do the multiplication of John Doe's weekly pay of $57.03 by 52 to get his annual pay. They do this by counting to 5703 52 times. Addition is simply two counting operations, and subtraction and division are done by counting forward, then backward. Even the most complex problems are solved this way.



When Binac reaches the "stop" signal, it prints the answer John Doe wants, but in octal figures. Converted to the decimal system, they say that he earns $57.03 a week, $2,965.56 a year, and $247.13 a month. An extra numeral is added as a spacer to separate the "words"—groups of numbers the machine handles together.

How Univac Adds by Two's on "Gate" Vacuum Tubes

To Univac, numbers are a binary code of electrical pulses and blank spaces (no pulses). Typical code, simplified slightly from Univac's, is shown below (X means pulse, and 0 means blank space).

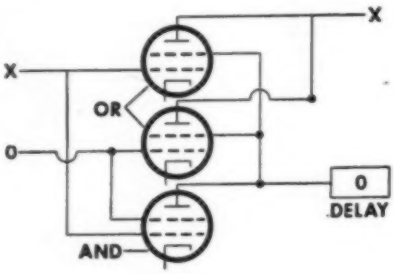
0=0000	5=0X0X
1=000X	6=0XX0
2=00X0	7=0XXX
3=00XX	8=X000
4=0X00	9=X00X

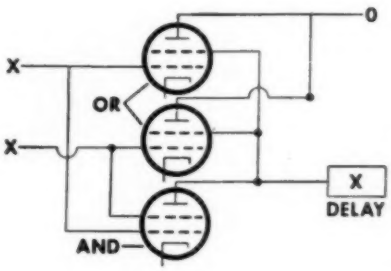
This code is added by ordinary rules: $0 + 0 = 0$; $X + 0 = X$; $X + X = 0$ and carry X (like $5 + 5 = 0$ and carry 1). Try adding 3 and 6 (below). First digit pair (at right) gives X. Second digit pair gives 0 and carry X. Third digit pair, plus carry from second, gives 0 and carry X. Fourth digit pair plus carry gives X.

3	00XX
+ 6	0XX0
9	X00X

Univac adds much this way with circuits similar to the one below. "Gate" tubes—which transmit a pulse only when both their grids are positive—are arranged in an "and" circuit and an "or" circuit that are used together. The "or" circuit has two tubes, each having one grid kept positive; the other grid must be made positive by an incoming pulse. Each tube receives one digit of a pair being added. The "or" circuit thus transmits only a blank if two blanks are received. If one blank and one pulse are received, it transmits a pulse, since one tube has its negative grid made positive. If two pulses are received, however, it must transmit a blank and carry a pulse to the next addition. This it does with the "and" circuit.

The "and" circuit has one "gate" tube, with both grids normally negative. Thus it sends a pulse only when it receives two pulses, one for each grid. It receives the same pairs of signals that the "or" circuit gets, but operates only when both signals are pulses. When this happens, the "and" pulse affects the "or" tubes, making one grid in each "or" tube negative, and the "or" circuit transmits a blank. The "or" answer becomes the total for that column, while the "and" answer is fed to a delay circuit. This "and" carry pulse is delayed until it can be added to the sum resulting from the following pair of digits. The second addition is done by another set of "gate" tubes much like the first.





or instructions—expressed in pulse signals—will be recorded on the tape by the keyboard or by the machine itself. When Univac must get a number back from the tape, motors will move the tape backward or forward until the pickup is at the desired spot. Special tapes can be made up containing tables of frequently used information—such as logarithms, trigonometric functions—and kept on file.

These components of Univac make an "information-processing system" that works strikingly like the human nervous system. In fact, psychiatrists and psychologists often find it valuable to study the nervous system as an electric computing machine. END

These two houses in Morgantown, W. Va., were painted at the same time, the one on the right with ordinary lead-containing paint, the other with the new lead-free finish. Close-ups above houses show how, after 14 months, lead paint blackened while new lead-free one didn't.

New Paints That A Novice Can Use

Modern chemistry is working to give you new finishes that look better, last longer, and are easier to use.

By George H. Waltz, Jr.

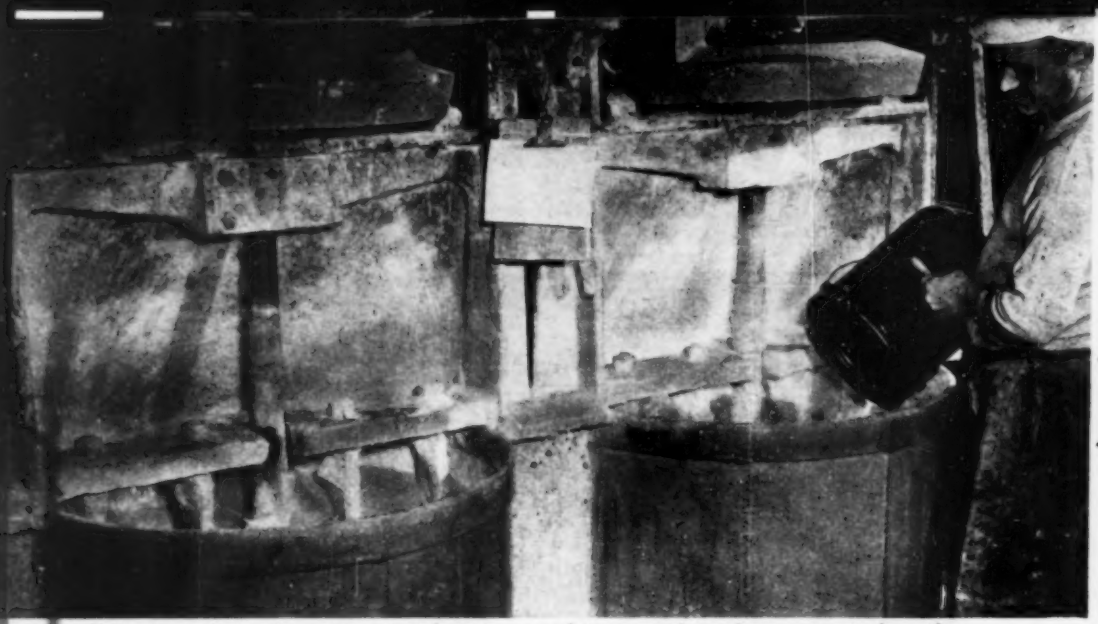
PS photos by W. W. Morris

IS YOUR house beginning to look shabby? Cost too much to have it redecorated, you say? Maybe you're right, but have you considered using any of those new finishes on the paint dealers' shelves?

Since the war, paint manufacturers have been vying to produce "wonder paints." Now, revolutionary new products are available to lighten your painting chores.

They began to appear in 1942 when government officials asked the manufacturers for water-thinned paints that would be durable. An array of resin-emulsion paints resulted. Many paint buyers looked upon them at first as a wartime substitute to conserve critical paint-oil supplies. Bad experiences with earlier so-called water paints were recalled. But last year householders bought 100,000,000 quarts of such resin-emulsion paints as Sherwin-Williams' Kem-Tone®, Glidden's Spred-Luster® and Spred-Flat®, and Du Pont's Speed Easy®. Their price, easy application, and cleanability, plus the fact that they can be thinned with tap water, have made the resin-emulsion paints increasingly popular.

Until this year, water-thinned paints were available only in the lighter, pastel shades. Now come deep shades of blue, red, yellow, green, sienna, burgundy, umber, and brown. Like the original light-hued wall finishes, the new, deeper, resin-emulsion shades go on easily with brush or roller and, in most cases,



Paint is made in three steps: initial mixing, grinding, and final mixing. In first mixing of Kem Glo®, at Sherwin-Williams' Newark, N. J., plant, where these pictures were taken, pigment and just enough synthetic resins to form thin paste are churned in big paddle mixers above. After grinding (right), color, other ingredients, and rest of resins are added for final mixing.

cover wall surfaces with a single coat. There is no change in mixing either—to every quart of paint you simply add a pint of water.

In a sense, the modern, water-thinned, resin-emulsion paints mark the completion of a cycle in paint-making techniques. Basically, a paint is nothing more than pigment mixed with a liquid that will allow it to be spread over a surface. The paints of the ancients were just that—pigment mixed with water. Later, man discovered that adding egg yolk would make them stick better. Still later, paint men found that oil formed a better vehicle, combining with the pigment to dry to a hard film. To speed up the drying, they added driers, and to make the oil more spreadable they added thinners in the form of turpentine or mineral spirits. And ways were found to add a wide range of coloring materials to the basic pigments. Today, synthetic resins have replaced some or all of the oil in many paints. In the new water paints the oil and resins are thinned with water.

Now, many more new paints are rapidly becoming available. Some already have been announced. Others are still in the laboratories of paint companies, and some are mere gleams in the eyes of chemists.

One that is just now reaching dealers' shelves is a gloss finish with a "baked-on-enamel" look that can be brushed or sprayed on as easily as any ordinary paint. Designed for use on walls, woodwork, metal, and furniture, the new paint—called Kem Glo® by its makers, the Sherwin-Williams Co.—dries without brush marks in from three to four hours to produce a hard, plasticlike, easily cleaned surface that looks like the finish on your refrigerator or kitchen stove. It can be used indoors or out and gives good, one-coat coverage over most surfaces without a primer or undercoat. Where two coats are needed, the new paint itself is applied for each coat just as it comes from the can.

New Paint Outwears Old

One of the paint engineers who helped concoct the formula for it coated a square section of the floor in front of the door to his much-used office with it to test it. Months of foot traffic failed to chip it or wear it off. The building maintenance crew then gave the whole floor its periodic coat of regular floor paint. Since then, continued scuffing has worn the ordinary paint thin to reveal the bare floor—and the enamel test panel, which is still holding up.

The new enamel finish gets its long-wearing qualities and "baked-on" look from a combination of titanium oxide, titanium calcium, synthetic resins, hydrocarbons (oils), and pure color. Just how these ingredients

After first mixing, paste of pigment and resin goes to big grinding machines, where five large rollers pulverize pigment into fine particles to give paint smooth texture and even consistency.

More paddle mixers, below grinders, give paint final, thorough mixing. Automatic filling machine above then pours just right amount of paint into each can as row passes by on conveyer.

are mixed is the paint manufacturer's secret.

The use of titanium compounds, however, is significant. Titanium pigments also form the basis of another new finish—a lead-free house paint recently announced by the Pittsburgh Plate Glass Co. This new outdoor paint, called Sun-Proof®, is said to resist darkening or graying even when applied to houses in or near large industrial areas where the air contains sulphurous fumes and other corrosive gases. Ordinary lead-containing paint blackens under such conditions because the hydrogen-sulphide gas in the air combines with the lead in the paint to form lead sulphide, which is black.

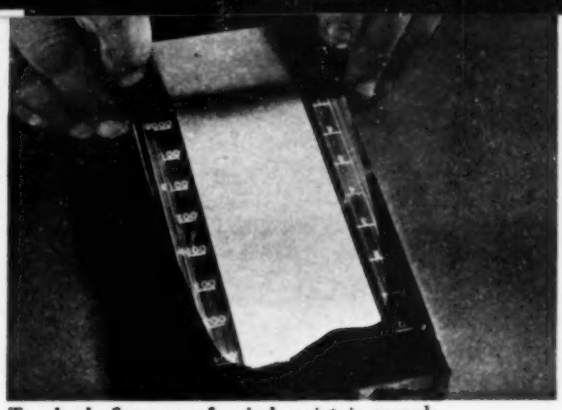
A special chalking (flaking off) process built into the new lead-free finish makes it literally self-cleaning. As the paint chalks off, rain washes away the old finish surface with the dirt.

Titanium is not new to the paint industry. Titanium oxide and other titanium compounds have been the paint chemist's idea of the whitest pigments for almost fifty years. Until recently, however, titanium compounds were expensive and hard to get. The ore, ilmenite, from which titanium oxide is obtained, is plentiful, but separating the oxide from it was not easy—until the chemists discovered the trick.

Just as pure titanium, because of its strength and light weight, has many uses as a metal (P.S., Dec. '48, p. 105), the compounds of titanium are valuable in paints for more than their whiteness and inertness. Their light weight also makes it possible to produce lightweight paints. In painting large bridges and boats, weight is important. By using titanium paints instead of lead paints,

The paint is not all that's new. This new spring-tension can top needs no pulling, pounding, or prying. It slides on and off easily, makes an airtight seal, and will not clog with paint.

How many coats will a paint job need? To find out, manufacturer spreads a paint over this black and white test pattern. Amount of pattern showing through measures paint's covering qualities.



To check fineness of grind, paint is spread along graduated strip until it thins to point where pigment particles can be seen. Length of this streak, read from scale, is then index of grind.

as much as 75 tons can be saved on a large liner or battleship.

A third new titanium-containing paint, recently announced by the Glidden Co., is a one-coat, outside house paint. It's said to cover so well that a single coat will do the trick on most repainting jobs where the surface is not too bad. On new construction, a single coat applied over a primer gives an appearance equal to two coats of ordinary paint. Tests have shown it to be extremely durable. A Texas gas station that was used as one of the first test jobs six years ago is still listed by the oil company's inspectors as "in excellent condition."

One Coat Saves Cost

Although this new paint, called Endurance Imperial®, costs about $2 more a gallon than the lead paints, its over-all cost, based on the one-coat claim, is little more than half that of ordinary paints. At the moment, the new finish is available only in white.

Another 1949 Glidden innovation is a primer and sealer called Spred Vapor Barrier®. It's said to seal perfectly with a single coat. It dries quickly, is virtually odorless, and can be used in place of the usual vapor-barrier paper required in new construction. It's even said to be twice as efficient as the minimum FHA vapor-barrier requirements.

If you want a real plastic coating that can be brushed or sprayed on like a paint, the Corrosite Corp. has it for you. Consisting of a combination of thermoplastic and thermosetting plastics, the new coating can be applied to wood, metal, masonry, and even cinder blocks. It is odorless and nonflammable when dry and extremely resistant to all kinds of corrosion. In a recent test, two metal panels—one coated with an ordinary high-quality enamel, the other with Corrosite®, as the new plastic paint is called—were immersed in a vat of sulphuric acid. The ordinary enamel dissolved immediately. The plastic paint covering was unaffected after 20 minutes in the corrosive bath!

Although developed primarily for industrial use, where a hard, long-wearing, chemical-resistant finish is needed, the plastic paint has numerous household applications. Providing a rugged, watertight surface, it is a candidate for concrete cellar floors, exposed porches, steps, and even roofs. Photographers can use it as a protective coating for darkroom surfaces. A gallon, averaging $6.95, will cover about 500 sq. ft.

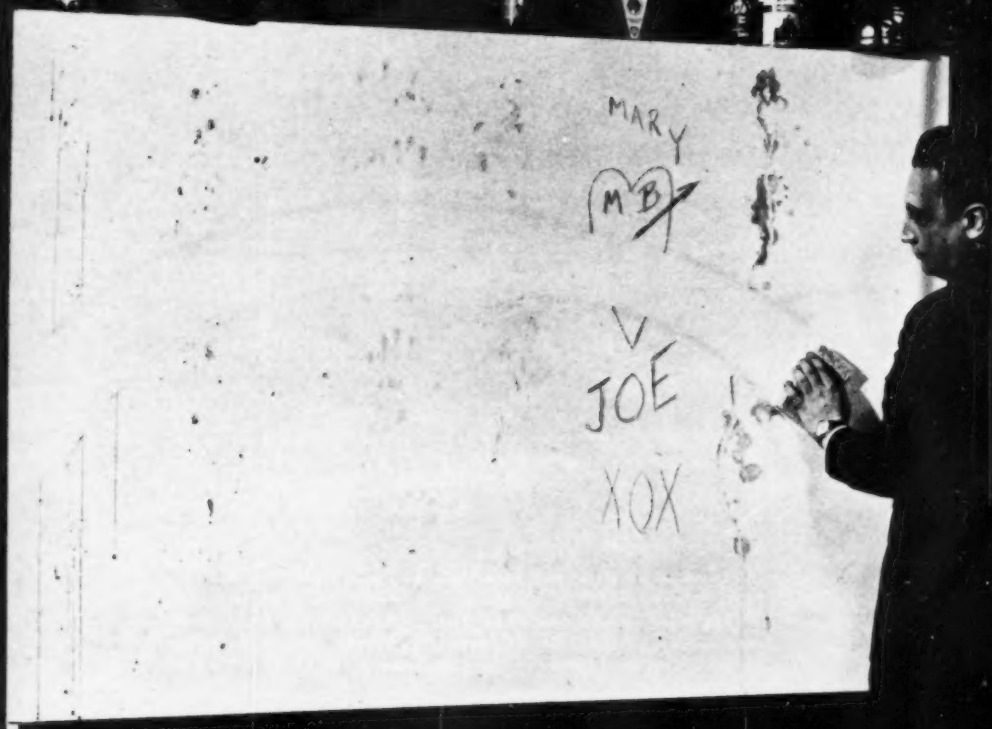
You can even mix up your own stainless-steel paint. A new stainless-steel powder, stirred into any fast-drying clear lacquer or spar varnish, can be brushed or sprayed on just about any surface to provide a decorative as well as corrosion-proof finish.

At Sherwin-Williams, Du Pont, Glidden, Devoe & Reynolds, Pittsburgh Plate Glass, New Jersey Zinc, and many other companies, the paint experts are striving for newer, longer-lasting, foolproof finishes that will protect as well as beautify. And one of their main objectives is to make it easier to turn out a good paint job. Their goal is to build the professional, smooth, mark-free look right into the paint itself, instead of leaving it to the skill of the brush wielder.

But probably the biggest news is a prophecy. According to most experts, all household paints will be of the easy-to-apply, water-thinned variety within fifteen years! The kitchen faucet will then replace the thinner and the paint-brush cleaner. END

Spray paints are tested by coating trial panel with spray gun. Next, paint will be heat-tested. During a production run, paint samples are tested every few hours to insure uniformity.

To pass brushing test, paint must go on smoothly and show minimum of those maddening brush streaks and lap marks. Nonabsorbent paper used shows up flaws other surfaces might hide.



Cleanability of the new Kem Glo paint is shown in this rough test. A painted panel, smeared (left to right) with ink, cooking grease, finger marks, Mercurochrome®, crayon marks, fruit juices, is easily cleaned with a standard wall cleaner. Even boiling water will not mar finish.

Additional proposal to tunnel-trestle crossing is sister span to parallel existing San Francisco-Oakland Bay structure.

Artificial sand islands, flanking channel, would carry tunnel entrances, ventilation plants. Lighted piles would warn ships.

Drawing above shows how concrete slabs would first be layed on pilings sunk in sand-filled trench, to check settlement in bottom mud. Tubes would then be lowered by crane onto slabs. Cross section below shows tubes covered with sand and rocks to hold them in place. The spaces at top and bottom of tubes would be provided for ventilation.

This Bridge Goes Under Water

Sand-fill causeway would extend more than mile into bay. Rest of overwater structure would be trestle on concrete columns.

A PREFABRICATED tunnel, built in sections to be dropped to the bottom, may help speed traffic across San Francisco Bay. It is proposed to carry a six-lane highway under the 50-foot navigation channel. Together with several miles of trestle and a mile-long causeway, the structure would stretch 6¾ miles between San Francisco and Alameda.

The unique, 6,000-foot-long tunnel would consist of three tubes of reinforced concrete, each 37 feet in diameter and carrying two lanes of traffic. The tube sections would be built in drydock near shore in 200-foot lengths and sealed at the ends with temporary bulkheads. They would then be towed floating to position, weighted with water, and lowered to the bottom by cranes. With the addition of each section, the bulkheads in the preceding one would be removed, permitting interior work to begin immediately. Special connectors would force the sections snugly together and rubber seals make the joints watertight. Walls of the tubes would be 2½ feet thick.

If approved by Congress, the project will take about five years—and $172,000,000.

Building a Shirt Around a Man

PS photos by W. W. Morris

ENGINEERING shirts to fit different sizes and shapes of men takes as precise blueprinting and assembly as building an automobile.

The related variables are neck, sleeve, chest, and waist. For each neck size from 13½ to 16, for instance, there is a 2-in. difference in body width; for each size from 16½ to 18, a 2½-in. difference in body.

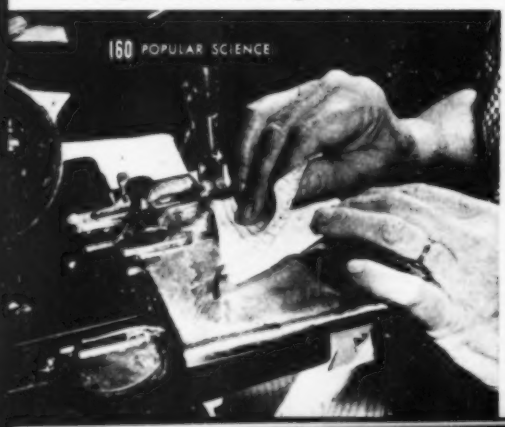
More than 60 skilled workers helped to make the shirt you are wearing. Among them were 42 seamstresses, who used 125 yards of thread and 17,250 stitches to join its 28 carefully cut pieces of cloth. So it's no wonder that POPULAR SCIENCE's reporter and photographer were surprised to see, on a visit to a shirt factory, that even white shirts stay sparkling clean through all this handling.

Photos of the shirt-manufacturing sequence shown on these pages were taken at the plant of the Manhattan Shirt Co. in Paterson, N. J.

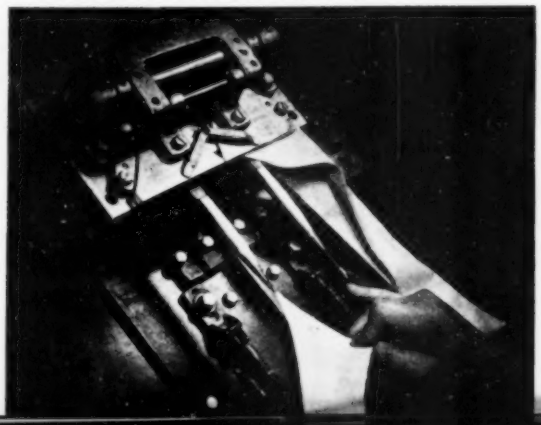
1. These wooden shirt-front patterns, size 13½ to 18, show the change in waist contour for each size. Smallest size, in foreground, is the most curved; largest size is straight across. The row of slots near the bottom of the pattern guide the cutter when aligning it on striped cloth.

2. Using a sharp, short-bladed knife, cutter cuts collars out of 48 layers of cloth. Pins protruding from material in front of worker guide him when spreading striped shirting on cutting table. In the foreground are a wooden pattern, a stack of cut-out collars, and a knife.

3. Sewing-machine operator (below) collects collar outside, underside, and lining for joining around the edge on the wrong side. All the points must be carefully cut to avoid excess material that would cause bunchiness when collar, after being sewed, is turned right side out.



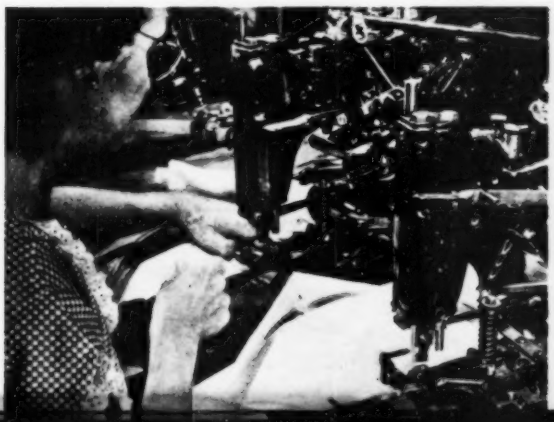
4. Collar point is placed wrong side out over dartlike tip of the turning bar on the machine below. Operator then draws point down over a die blade to pull collar right side out, hiding seam. Blade now moves collar up into die, as shown at right, for shaping and pressing.

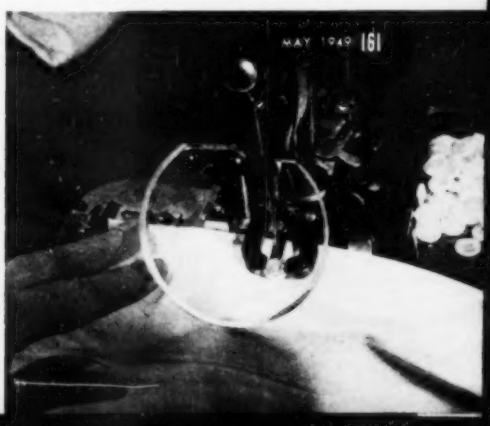


There are 2½ yards of cloth, cut into 28 pieces, in a shirt like the one worn by the model above. The yoke has two pieces; the cuffs, neckband, and collar have three pieces each. Some types of collar require additional pieces. The back of the shirt (top center) is slightly arched toward the top edge, where it is sewed to the yoke, in order to give wearer room for reaching and stretching. A shirt also gets necessary fullness from a generous width allowance, and from gathers or pleats sewed in near the shoulder blades. Those are points to watch for in buying a shirt.

5. Worker positions cloth in buttonholing machine at center below, while machine at right sews a buttonhole in another piece of goods. After a buttonhole is sewed, a knife located behind the needle descends with lightning speed to slit hole between the rows of stitching.

6. Button, gripped by three-prong holder in machine below, is sewed on shirt with 18 stitches. Correct distance to next button is determined by moving the sewed button to a metal stop near operator's hand. Circular glass guard on sewing machine shields worker if needle breaks.





7. Machine above creases pocket, lying on steam plate, over a die (in raised position) to give it uniform shape. As die descends, slotted plates move toward pocket, turning up edge.

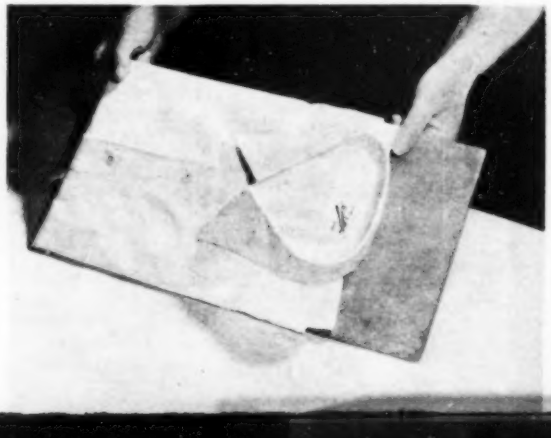
8. Pocket stitcher, one of the fastest seamstresses in Manhattan Shirt Co. plant, picks up pocket, matches its stripes with shirt-front stripes, and sews it on in a matter of seconds.

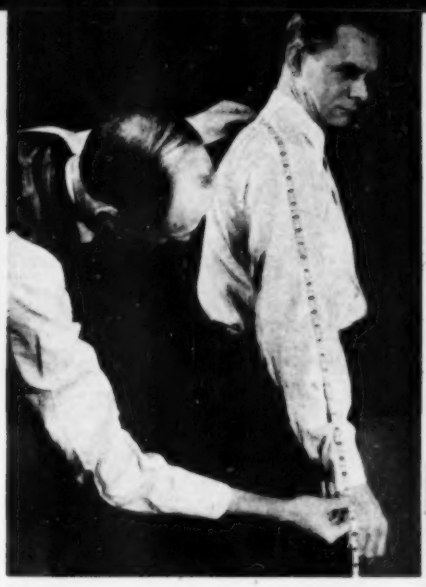
9. In this operation, called felling, a seamstress sews a double seam in the shirt from the end of sleeve down to the tail. A curled metal plate, in front of the two-needle foot, turns under the raw edge of the fabric. Note spotlight on work.

10. In the laundry, neckband is starched to size-fix it, and give wearer a comfortable feel on the neck. After starching, neckband is placed on curved press, as shown above. Machine head, here raised, comes down on neckband to dry it.

11. After size-fixing operation, collarband is measured (below) with flexible steel ruler from inside of button to outside of buttonhole. This measurement must come within 3/16 of an inch of the size stamped on the inside of the collar.

12. Before a shirt is ready for shipment from the factory, a cardboard form is inserted to aid the worker in folding and pinning the shirt tightly. The cardboard base is then removed, as shown above, and the shirt is packed.



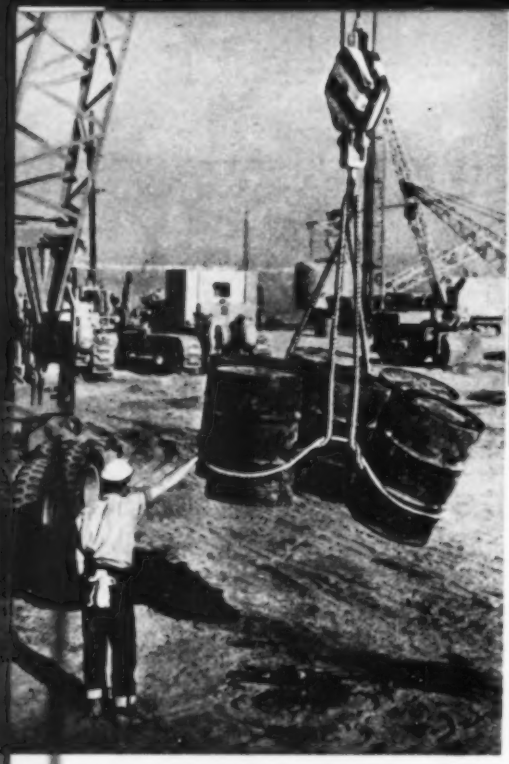


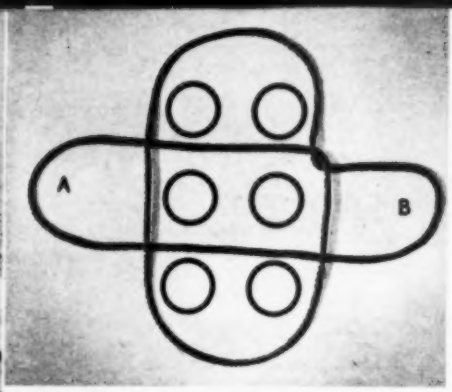
How to Find Your Correct Shirt Size

To FIND your neck size, measure at place where neckband normally rests as shown at left above. Add half an inch for comfort. Tape above shows 15½; model then should wear a size 16. Correct sleeve length is obtained by measuring from the center of your back near the neck to the end of sleeve. Tape (right above) shows the model needs a 34.

How to Fold a Shirt for Traveling

You will have more room in your suitcase and fewer wrinkles when you unpack, if you fold shirts as shown in these four photos. First, lay the shirt front down, folding back sleeves and part of shoulders, as at left above. Then fold the garment in three parts horizontally, as at right above. Starting with the tail, next fold shirt in four parts vertically, as at left below. Result, at right below, shows shirt ready for packing. Folding a shirt in this way also saves space in your bureau drawer at home.





Trick Sling Lifts Six Barrels

TRY picking up six heavy oil drums with a single loop of rope—and no knots, please. The Chinese invented the trick, and now it's saving time and work for the Navy's Seabees. A 30-foot-long, endless loop of 3-inch manila rope is arranged around the barrels as shown above. Loops A and B are then simply hooked onto a crane, as shown at left. The rope is kept tight by the drums' weight and can't slip off if looped below the barrels' bottom rings. Called the Chinese Barrel Sling, the method is said to be the fastest yet devised and particularly suited to loading at sea.

Mobile Saw Cuts Logs and Costs

THIS mobile "sawmill" goes right to the trees, saving logging costs and making small jobs profitable. Assembled (left), it has a 56-inch blade and handles logs up to 18 feet long. Knocked down and packed on a trailer (below), it's only 32 feet long. In a day, it can saw 3,000 board feet of hardwood or 5,000 board feet of pine or poplar. Built by the West Virginia Agricultural Experiment Station, the sawmill can be set up in half a day and knocked down in 1½ hours. An 86-hp. Diesel engine drives the rig.

Professor Kempton demonstrates how to hold a dogfish that he has caught off pier at the Marine Biological Laboratory at Woods Hole, Mass. Balloon is to collect urine for kidney study.

For study, dogfish is tied belly-up to trough, head in tub of water to keep it alive. Water temperature and oxygen content must be just right. Here Dr. Kempton collects urine in syringe.

Dogfish Aid Medical Research

FISHERMEN hate dogfish, the littlest sharks, for their love of lobsters and fish. But they've found a friend. Biologists think they're useful—and extremely interesting.

For example, put a normally gray dogfish into a white-walled tank of sea water. Within two hours his hide will have bleached out close to white. Put another dogfish into a black-walled tank with no lights. Within two hours his skin will be extremely dark. Swap fish—and they'll swap color too!

Put blind dogfish into the two tanks, however, and nothing happens. The dogfish must see the color of his environment before he can change to match it.

Prof. Rudolf Kempton, of Vassar, is studying dogfish kidneys. He hopes to find out more about the human kidney—although the dogfish kidney acts just the opposite.

A human kidney works hard to get rid of urea. If it fails, an overabundance poisons the system. But the dogfish thrives on urea—the more the better. It keeps the fish alive by preventing his blood from being dissipated. So the dogfish kidney takes in blood and extracts urine.

How the fish makes the kidney do this is what Dr. Kempton is trying to find out.

Blood samples also are taken, as shown in close-up above. Fish are kept in well under pier and returned to it after examination and taking of samples. Blood and urine are analyzed in lab.

Your New

Instruments that warn of unseen rays are readied for mass output to meet needs of peace or war.

By Alden P. Armagnac

Geiger counter can measure the level of molten metal in foundry cupola, as above—or map radioactive contamination after an A-bomb blast.

FROM a box resembling a radio cabinet comes a string of sharp metallic clicks like those of a telegraph sounder—infrequent at first, then in rapid succession.

That is the atomic-age alarm. More and more people are hearing it. Some day your own safety may depend on it.

The chattering noise comes from a Geiger counter, one of the principal instruments used to locate radioactive substances. Lack of any human sense to detect the invisible rays makes them necessary. About 60,000 radiation detectors are being used today on Government atomic projects alone. Once physicists had to invent and build these devices to suit their purposes. Now two dozen American firms make complete instruments, and others produce their components. About four million dollars' worth of them were produced last year, and increasing applications are multiplying the demand for them.

So manufacturers are now preparing to turn out tubes and other parts for them by the tens of thousands, like components of radio receivers; and soon Geiger counters are expected to be in mass production. Besides meeting peacetime needs, assembly-line manufacture of radiation detectors will solve the problem of supplying the enormous number that would be needed in an atomic war.

Twenty-three varieties of radiation detectors, a representative array of the latest models, recently were exhibited by the U. S. Atomic Energy Commission at a conference of electrical and radio engineers in New York City. One of the newest, a "scintillation counter" with a light-sensitive photo tube that responds to luminous scintillations of a crystal, excels at registering neutrons. The AEC calls it "the most important advance in radiation-measuring instruments for nuclear research" made during 1948. Because the neutron has no charge, the ordinary Geiger counter will not detect it effectively.

You can take your choice of other models especially suited to detect alpha, beta, or gamma rays. Some employ a Geiger tube, a device in which radiation causes a sudden, brief electrical discharge between a charged wire and an encircling metal cylinder—with a resulting click when the pulse of current is amplified. Others use an ionization chamber, a form of electrical condenser whose charge gradually leaks off on exposure to radiation and is measured by an indicator on the scale of an electroscope. Many go by fanciful nicknames—"Juno," "Zeus," "Cutie Pie," "Walkie-Squawkie," and "Pocket Screamer."

All these varied models, however, can be simply classified according to purpose:

1 **Radio-chemical analysis.** Geiger counters that detect the rays of radioactively tagged substances, in medical and chemical "tracer" experiments, belong to this

Eyes and Ears

group. They may be elaborate affairs with such refinements as automatic dials, like mileage meters, to record the total number of clicks. These research-type models are not usually intended to be carried about.

2 **Health-physics survey meters.** These are designed especially to be carried from place to place. Non-experts may use them to locate radioactivity. In trained hands, they also serve to measure its intensity. Prospectors employ them to find uranium-bearing minerals. Health-physics experts use them to test the radiation from uranium piles and other "hot" spots in atomic projects and make sure that workers and dwellers nearby are not endangered. In atomic warfare, these would be the radiation detectors rushed to the scene of an atom-bomb explosion to re-

Full dress for a radiation sleuth includes a combat-type mask to avoid inhaling radioactive dust, protective coveralls, and a long "fish-pole meter" to test objects for radioactivity at a safe distance. He carries an electroscope-type meter in other hand, and wears two pocket meters and a sensitized-film badge to check on how much radiation strikes him.

veal the areas contaminated with radioactivity.

Where radiation is intense, a pistol-grip hand instrument of the ionization-chamber type, the "Cutie Pie," is considered the most reliable survey meter. Others using Geiger tubes, however, are the most sensitive. Slung from a shoulder strap, a typical Geiger-counter survey meter consists of an oblong case about the size of a worker's lunch box, with a short flexible cable leading to a shiny metal baton. Wielding the baton in his hand or on a pole, the surveyor uses it to test objects for radioactivity, watching a dial on the case or listening with a headphone. Designers have been making strides in reducing the size and weight of survey meters.

The smallest of all, a tiny meter small enough to fit in the pocket and called the Audeton®, uses no batteries. A built-in, spring-operated generator supplies power to charge a condenser that operates a Geiger tube about the size of a cigarette for nearly two hours. You wind up the generator by pulling a knob attached to a drawstring. The earphone is a midget hearing-aid button.

Another novelty, recently proposed, is an attachment that would convert any home radio into a stationary or portable radiation detector. This might have emergency application in wartime. According to William D. Schafer, of the Los Alamos Scientific Laboratory, it could consist simply of a suitable Geiger tube with an adapter plug fitting into one of the set's regular tube sockets. The radio set would serve as the amplifier, and its loudspeaker would make the signals audible. Problems of manufacturing such a device remain to be worked out.

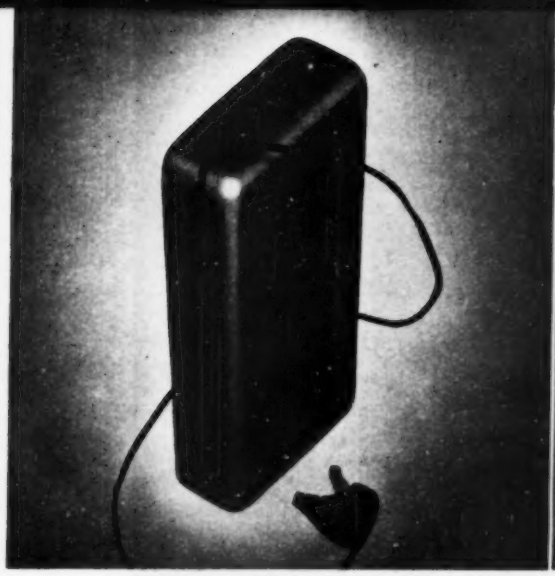
3 "Personnel-monitoring" detectors. While survey meters tell a user how "hot" the surroundings are, personnel-monitoring meters reveal what concerns him most of all—how much radiation his body actually receives.

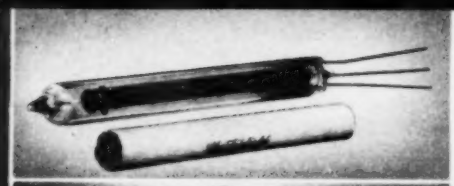
Human exposure to radiation is measured in units called roentgens. One-tenth of a roentgen per day has long been the accepted safety limit for workers regularly exposed to radiation in peacetime pursuits. This has been considered the maximum that the body can tolerate over long periods of time—say, 20 or 30 years—with assurance of no ill effects. Expert opinion now favors a limit of only three-tenths of a roentgen per six-day week, half of the figure above, to give an even greater safety factor.

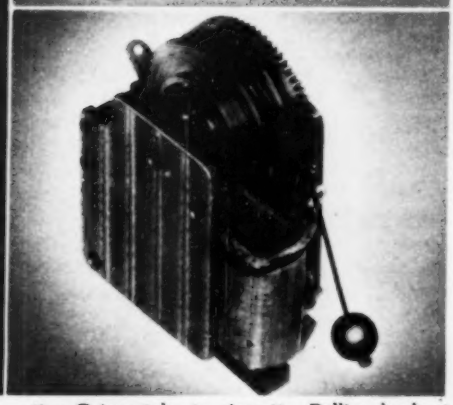
No apparent ill effect results from far greater doses of radiation, however, if exposure is brief. Then it takes at least 50 roentgens to cause even mild nausea or "radiation sickness," from which recovery is complete. A fatal dose is as large as 200 to 600 roentgens. Therefore troops and civil-defense workers who might be called upon to expose themselves to radiation in a wartime emergency could safely use much higher tolerance limits than regular peacetime workers. But they, too, would need personnel-monitoring

Resembling fountain pen, this "pocket chamber" (below) is worn by worker in "hot" area. At end of day it is placed in measuring instrument (inset) that reveals how much radiation he got.

"Pocket Screamer" worn on belt automatically sounds an alarm, warning user to get out of danger zone, when his exposure to radiation reaches the limit he can safely absorb daily.







Miniature radiation detector above gives audible signal through hearing-aid button worn in ear. View at upper right compares size of its tiny Geiger tube to cigarette. Pulling knob at end of drawstring works built-in generator, lower right, that makes batteries unnecessary.

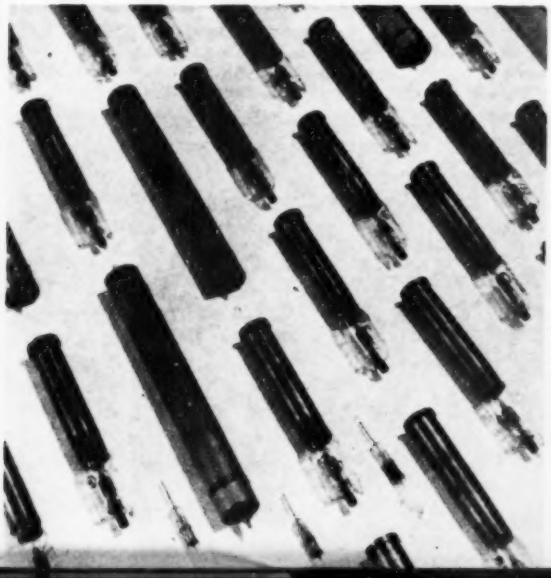
radiation detectors to warn of reaching this limit.

Badges or finger rings containing X-ray film, darkened by radiation, are among the simplest of personnel-monitoring devices.

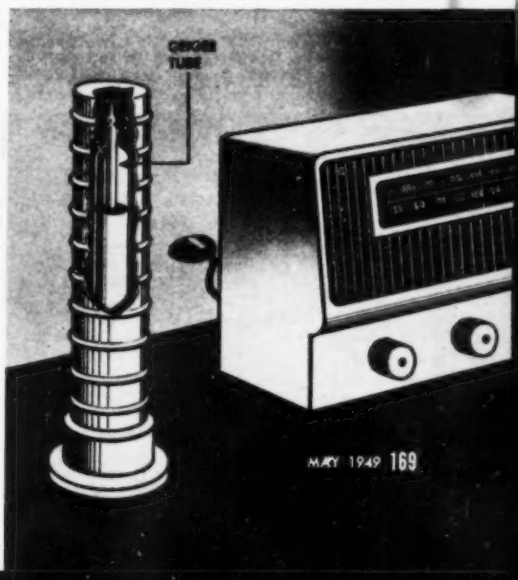
Meters worn on the clothing may be as small as fountain pens, which they resemble. These are miniature ionization chambers. In one type a moving hairline, on a tiny scale, gives a direct reading. Others, more rugged and better suited for untrained users, must be placed in a separate instrument for reading. Still needed has been a compact instrument that would give a positive warning when the tolerance limit was reached.

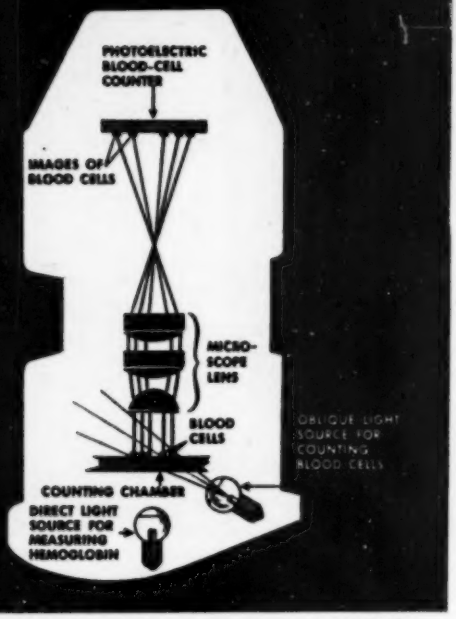
The new "Pocket Screamer" does this. Clipped to the belt or carried in a pocket, it contains a midget ionization chamber. When radiation discharges it to a preset level, a relay closes automatically and sounds an alarm buzzer—warning the wearer to get out of the "hot" area. END

Mass production of radiation meters is on the way as makers develop precision manufacture of parts in quantity. Here is an array of Geiger tubes from Westinghouse plant at Bloomfield, N. J.



Even home radios might be converted to radiation detectors by attachment like this, according to a recent proposal. Idea awaits commercial development of a Geiger tube suited to purpose.





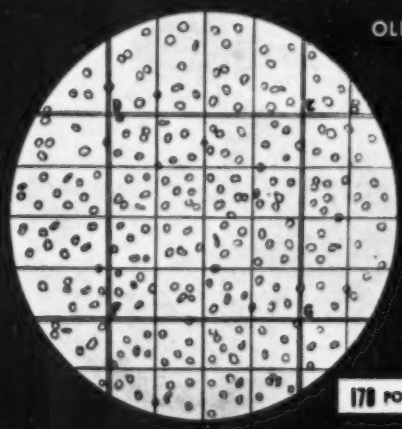
Automatic counter instantly tallies corpuscles in blood sample inserted at left. Oblique lighting makes them bright against dark field, and total light reaching photo cell depends on their number. Separate specimens, prepared with different solutions, are used for red and white corpuscles. Latter specimen is also used, under direct lighting, to measure the hemoglobin content.

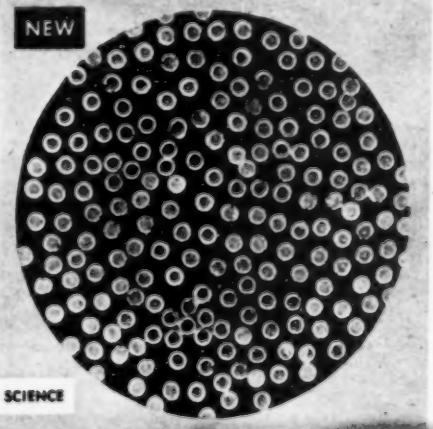
Photo Cell Counts Blood Cells Faster

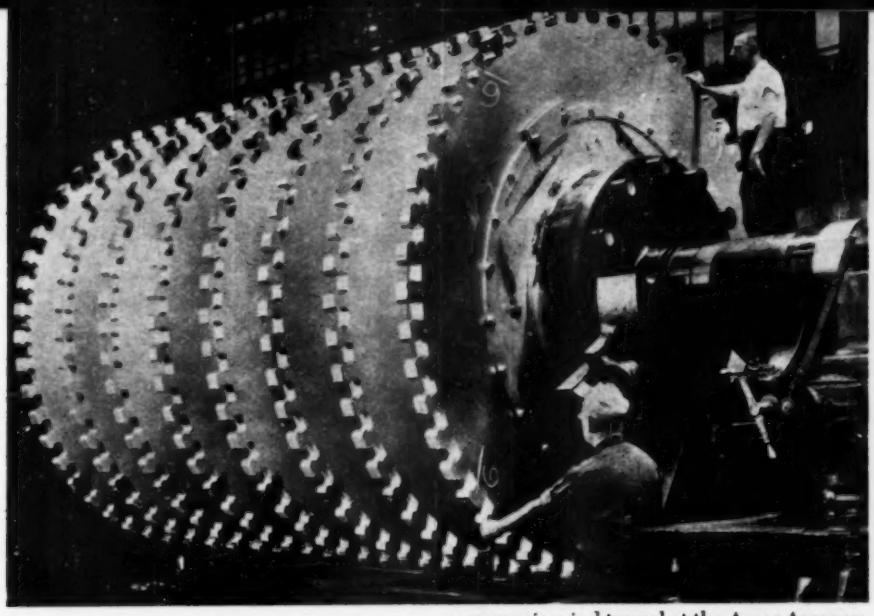
A NEW microscope with a built-in photo cell makes blood counting speedy and automatic. With it, any nurse or office assistant needs only 15 seconds to count red and white blood corpuscles in a blood sample and measure its hemoglobin. A trained technician, using a conventional microscope, requires 15 minutes for the task. The sketch above shows how the Photomicron® works.

The new device should prove invaluable in busy clinics and hospitals where large numbers of blood counts are a daily routine. For doctors in localities distant from a large city or hospital, it will provide blood-testing facilities unobtainable before. The Photomicron could also play a vital role in such an emergency as an atom-bomb attack. This would require rapid blood tests on an unprecedented scale for treating radiation injury.

Drawing at left, below, shows how red corpuscles in standard counting chamber look to technician at microscope, who must count the number within a ruled area one by one. Drawing at right shows how they appear, in the new instrument, to a photo cell that gives an instantaneous tally.







More Wind for Wind Tunnels

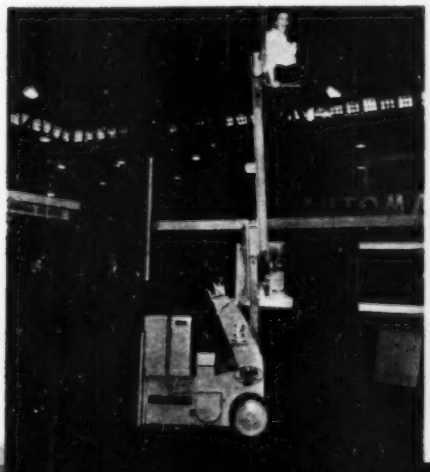
MAN-MADE cyclones, 10 times more powerful than nature's, will be everyday work for this big Westinghouse air compressor. Driven by two 25,000-hp. electric motors, it will whip up 1,500-m.p.h. gales in a new supersonic wind tunnel at the Ames Aeronautical Lab at Moffett Field, Calif. Each of the eight giant disks on the 123-ton rotor above is 12 feet in diameter and four inches thick. Two-foot-long, propellerlike blades on the toothed rims will blast 1,000,000 cubic feet of air a minute through the tunnel.

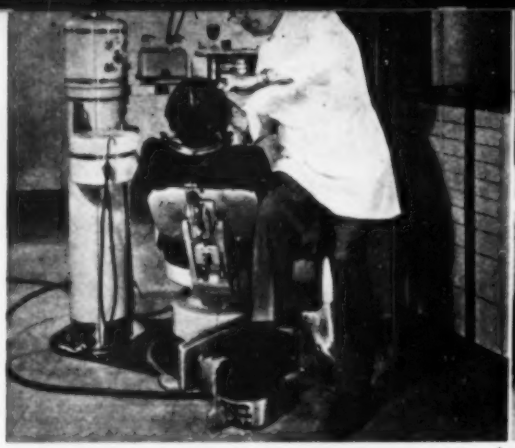
Light Guides Driverless Truck

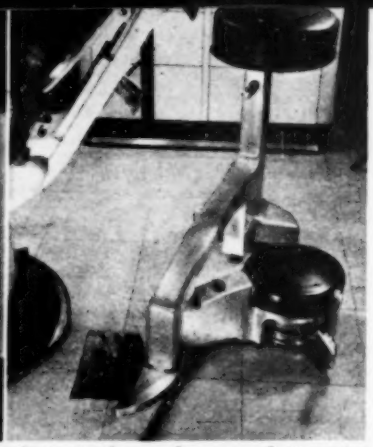
THIS new materials-handling fork truck can start, stop, back up, turn around, and raise, lower, and tilt its cargo boom—all without a driver. By varying the frequency of pulses of a light beam with a stroboscopic disk, an operator at a distance (hidden in picture below) can make the truck do nine separate jobs. Photo cells on the truck translate the light into electrical impulses that actuate hydraulic controls. The Automatic Transportation Co. built the truck—but only as a special exhibit: no production is planned.

Retractable Skeg Aids Barge

A SIMPLE trick long used in small sailboats with centerboards is helping to make cargo barges more maneuverable. The new barge below has a small, retractable skeg on one end. In pull-towing, the skeg is lowered to keep the barge from yawing; in push-towing, it is raised out of the way. The other end is squared off so two of the barges can be butted together and towed as a single unit. Designed by Butcher-Arthur and built by Dravo, the barge is 240 feet long and can carry 2,500 short tons of dry cargo.





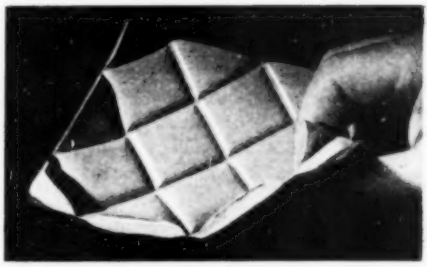


Stool Lightens Dentist's Work

Dr. Carroll Johnson, a Chicago dentist, is shown using the Rota-Seat® he invented to let him work sitting down. As seen at right, above, the rubber-wheeled stool is hinged to a plate that anchors under the patient's chair. As the stool is moved, it carries along a footrest with a drill-control pedal. Varying the relative positions of chair and stool, adjusting their heights, and sitting side-saddle or astride the eccentric-swiveled seat positions it for 80 percent of all dental operations.

Plastic Quilted for Upholstery

At right is a new kind of upholstery, made by electronically heat-sealing a sandwich of fire-resistant filler between two sheets of Vinylite® plastic. This method of quilting is quicker than stitching and produces a material with a tough surface that is easily cleaned. Called Sealtuft®, it can be used on furniture, in automobiles, and as a decorative wall covering.

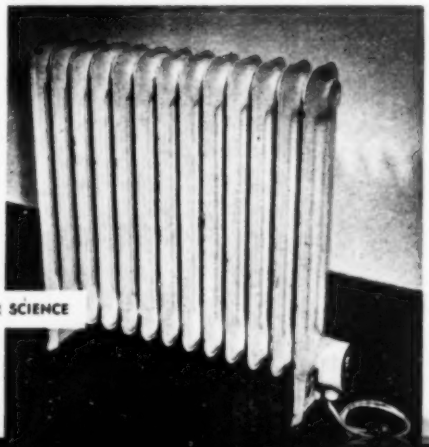


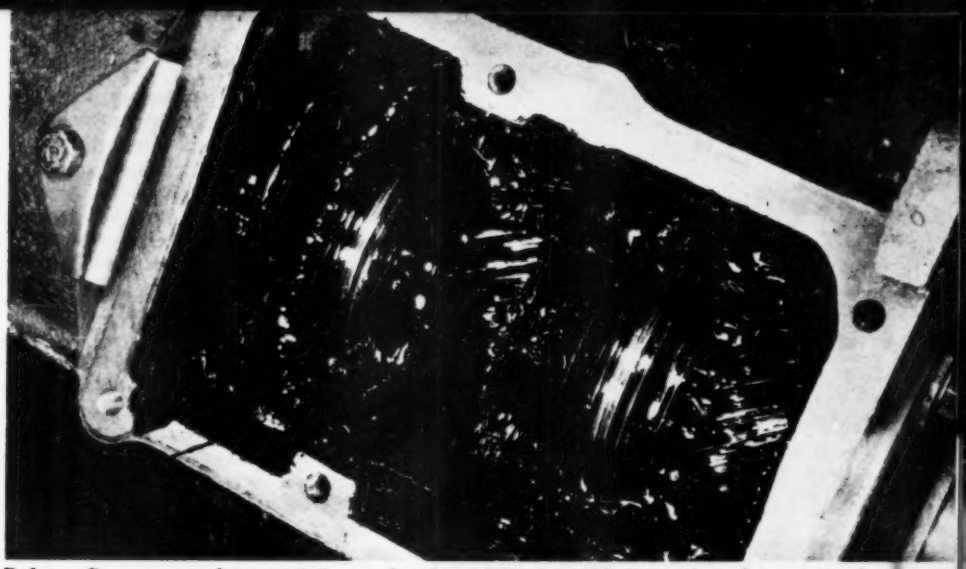
Books Read from Microcards

To save library space, books are now being copied photographically in microprint on file cards. For reading, a card is put into the Micro Library Reader® below. This magnifies the image 24 times in projecting it on a screen. Each 3- by 5-in. card—a fine-grain photographic print—holds 30 to 200 pages of text, depending on original size.

Electricity Heats Oil Radiator

This liquid radiator (below) needs no central furnace, plumbing—or safety valve. It is heated by electricity and, instead of water, contains a permanent, sealed-in supply of low-expansion, heat-retaining oil. Made of pressed steel, the Hurseal® unit is light enough to carry from room to room and plugs into any electrical outlet.





Before: Grease-covered transmission to be cleaned is seen with inspection plate removed.

Vaporizer Degreases Machinery

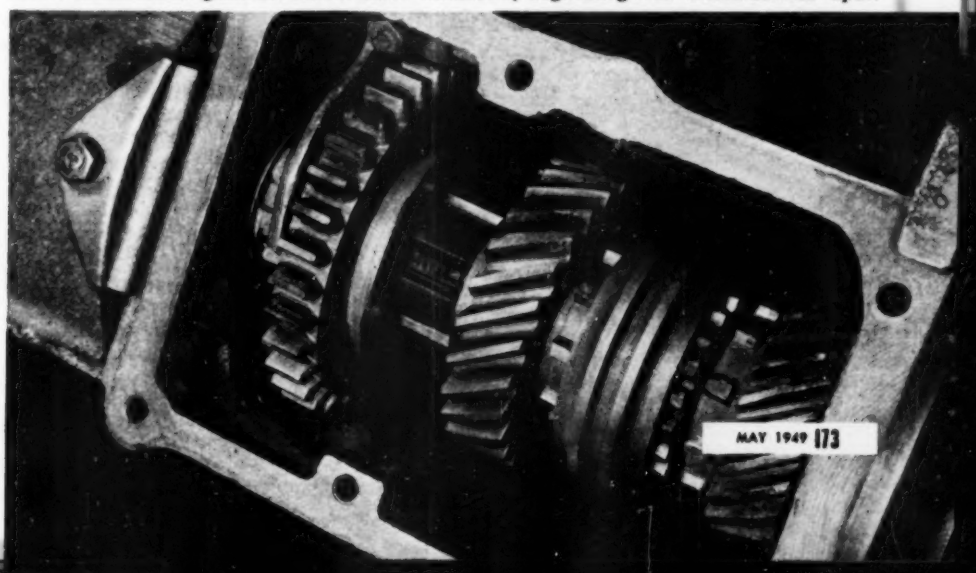
Ten seconds in chemical steam bath leaves transmission gear as clean as white shirt just back from laundry.

By Ray Milholland

WASHING heavy oil or grease off an automobile transmission gear by condensation of the vapors of a volatile solvent is no thing to watch if a man scares easy.

The business goes on right in front of your eyes, but at first all you see is the transmission gear, coated with thick goo, being lowered on a metal hook into an apparently empty tank. About a foot from the bottom of the tank, the grease starts running off the gear. Suddenly, the grease has all run off. Then a clear liquid starts trickling from the lower edge of the gear in a steady stream. Almost

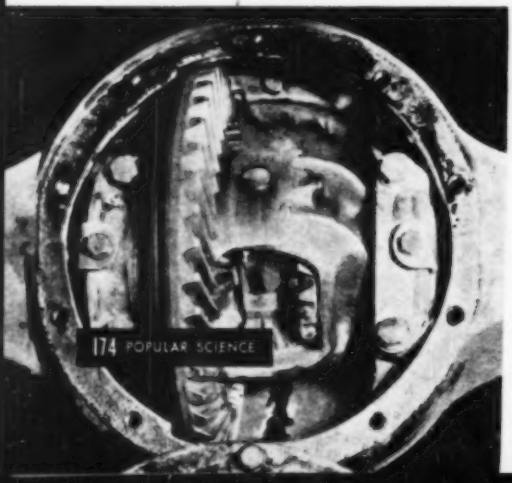
After: Transmission gears are shown below cleansed by degreasing with volatile-solvent vapor.



Portable degreasing gun goes into the filler hole of automobile differential. Plug-in electric heater vaporizes solvent in can. Pressure forces vapor through nozzle into gear housing.

Differential before cleaning, seen with plate removed, is gooey with dirty grease and oil.

Differential after cleaning is shown below. Condensed vapor has washed grease out drain hole.



as suddenly, after a few seconds, the clear trickle of liquid stops. The transmission gear that was a gooey blob eight or ten seconds ago is now clean—*chemically* clean, cleaner than a white shirt just back from the laundry.

Where did that trickle of grease-washing solvent come from? Where did it go when it suddenly vanished? The whole creepy performance is the result of collaboration by the familiar partnership of science and engineering.

Science pulled apart a molecule consisting of hydrogen and carbon atoms and inserted three atoms of chlorine. The result was trichlorethylene—a clear, volatile liquid that is 1.46 times heavier than water and boils at 188° F, or 24° below the boiling point of water. Trichlorethylene has gasoline or ether beat all ways from the ace as a solvent of organic oil, grease, wax, and tar. Among the reasons are that it is classed as a nonflammable solvent and gives off a vapor more than four times heavier than air.

Degreasing Is Big Business

Now, any time science comes up with a new grease solvent, engineering is immediately full of interest. For the removal of grease and oil from metal parts that must be painted or electroplated runs into an industrial cleaning bill of millions of dollars a year. And when the new solvent is nonflammable and loaded with other qualities of an ideal industrial solvent, engineering grabs it and puts it to work by designing degreasing apparatus for its specific use.

In its simplest form, the degreasing apparatus for employing trichlorethylene—Du Pont calls it Triclene D®—is a stainless-steel tank 17 inches square and 36 inches high. That is the Cub® model, manufactured by Circo Products Co., of Cleveland, and designed for small machine shops and automobile service departments.

The tank has a double bottom, the lower compartment housing electric heaters for vaporizing the solvent. The work compartment of the tank needs only four gallons of solvent to provide enough degreasing vapor to clean 290 pounds of steel parts an hour. A thermostatic control maintains the vapor level inside the tank at 17 inches.

To clean a batch of parts, they are lowered into the tank in a basket or on a hook. When the parts enter the vapor zone just above the level of the boiling solvent, the vapor immediately starts condensing on their cold metal surfaces.

This is the same thing that happens when steam strikes a cold window pane and condenses to drops of water. The concentration of trichlorethylene vapor, however, is much higher than that of water vapor at the same temperature. Because it takes only about one-ninth as much heat to vaporize a pound of trichlorethylene as is needed to vaporize a pound of water, a small change in temperature caused by contact with the cold, greasy parts produces a relatively large volume of condensate.

The condensed vapors are highly solvent and quickly strip all grease, tar, oil, or waxy substances from the metal. The contaminated solvent drips back to the bottom of the tank.

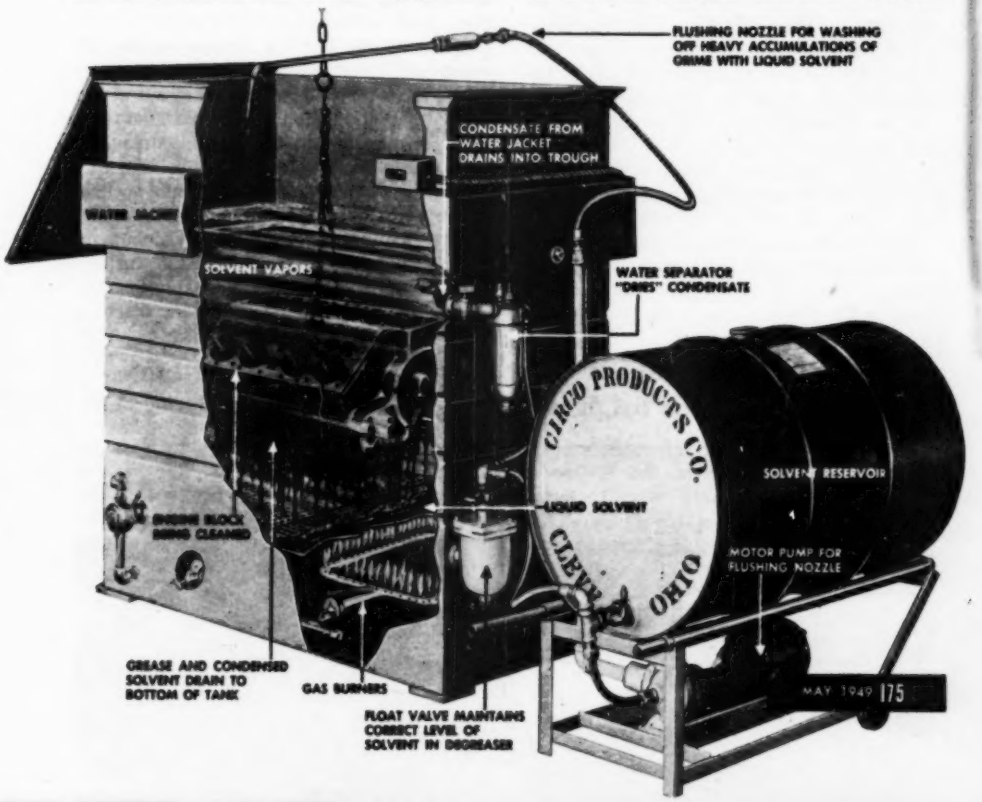
There it is reconverted into clean vapor by the heaters. Since the sludge and grease stripped off the work have a much higher boiling point than trichlorethylene, they do not distill into vapor again with the solvent. So, as long as there is a reasonable amount of solvent in the bottom of the tank, the cycle of vaporization and degreasing with pure solvent vapors can go on. It stops only when the work has been warmed to the temperature of the vapors. Condensation then ceases, and the work—washed clean—is lifted out of the tank.

If the work is inspected immediately after removal from the tank, any cracks or surface defects in the metal are readily detected by a fine line of wet solvent seeping out of the cracks.

The fact that trichlorethylene is soluble in water only to the extent of one part in a thousand is an indication of its chemical stability. Hence, all of the common metals—iron, steel, copper, zinc, aluminum—may be degreased by its vapor without etching their machined surfaces.

Trichlorethylene carries an Underwriters classification as a nonflammable solvent. It has no open-cup flash point. Its vapor, however, begins to break down chemically when in contact with hot surfaces of temperatures above 750°F. Thus, while the solvent is considered safe to use under normal shop conditions, the degreasing process should not be carried on near heat-treating furnaces or where welding is done. Very hot surfaces or an open flame will cause some of the ⇨

In medium-size model of vapor degreaser, shown below, the solvent is heated by gas burners. A water jacket around upper compartment of the tank speeds condensation of cleansing vapors.



chlorine to be released from the vapor. The vapor is nonexplosive.

Because the solvent vapor is 4½ times heavier than air, it mostly remains down inside the degreasing tank. If strong drafts across the top of the tank are prevented and the work is lifted out slowly enough to prevent pumping the vapor out of the tank, only a slight aromatic odor in the vicinity of the degreasing apparatus is noticeable.

Since trichlorethylene is a powerful solvent of all types of organic grease and oil, repeated contact of the fluid or hot vapor on the hands will extract the oil from the skin and cause dryness and cracking.

Its toxicity is rated as low compared with that of most volatile solvents. But the vapors of all solvents, except water, are considered toxic to some extent if the concentration is great enough and the time of repeated exposure is long enough.

Safer to Use Than Naphtha

Trichlorethylene, if inhaled in considerable concentration, can cause dizziness and a feeling of fatigue. Ordinarily, a few deep breaths of air bring complete recovery. In extreme cases of exposure, the victim may need a complete rest and a doctor's care. There is no medical record of any accumulative bad effect on the human system from the vapor of trichlorethylene. It is far safer to use than either naphtha or some of the other chlorohydrocarbon solvents.

Where large quantities of parts are to be degreased by the vapor method, the apparatus is more complicated and costly than for the dip method used in small machine shops and automobile service departments. These high-production machines are equipped with automatic conveyers. The work is hung on hooks or placed in baskets and carried through the degreaser on a continuous conveyer chain.

During this process, the work is first submerged in liquid solvent or passes through a liquid spray. It then is carried over a draining rack—all enclosed—to the final vapor stripping chamber. The work comes out warm, but not uncomfortably hot to the bare hand, and is dry and chemically clean—ready for inspection, painting, or electroplating.

Portable Model Cleans Differential

Vapor degreasing has also been adapted to cleaning out old and contaminated grease from automobile transmissions, differentials, and overdrives before adding new, clean lubricant. The device used for this looks like a paint-spray gun and is manufactured under the name Dee Tee® by Circo Products.

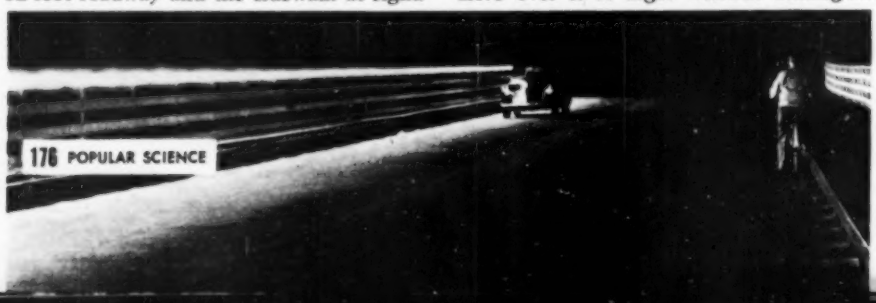
In using this small vapor degreasing device, the drain plug of the housing is removed and as much of the old oil is allowed to drain out as will flow while the service attendant is lubricating the other points of the chassis. When the attendant is ready to clean out the residual grease from the housing, he screws a small can of Circo Dee Tee Solvent® to the electrically heated part of his small portable vapor degreaser.

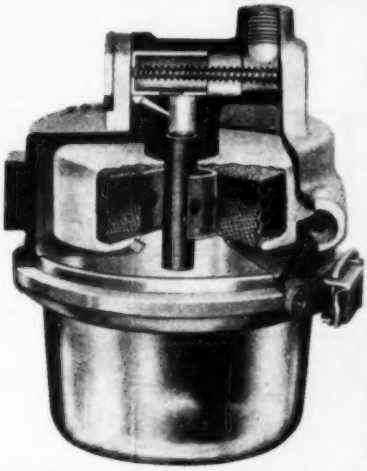
After a few moments, the solvent is sufficiently heated to generate a flow of vapor through the nozzle. This is inserted in the filler hole and sealed vapor-tight by an adapter. In less than ten minutes the solvent vapor will thoroughly strip all old oil or grease from the housing, washing out at the same time any small metal particles that have accumulated. When the contents of the small can of solvent have been completely vaporized, the interior of the housing is clean and dry—ready for refilling.

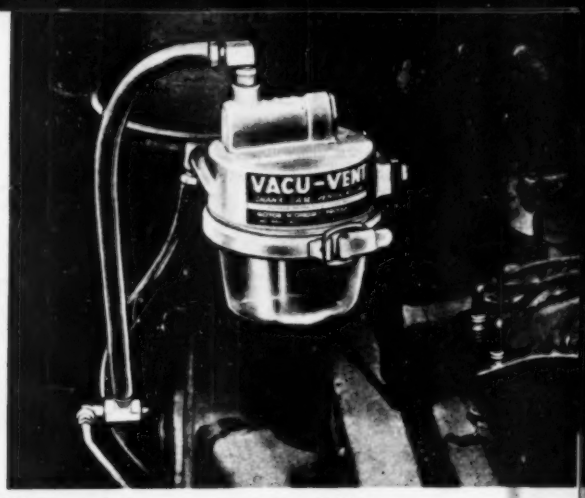
The manufacturer does not recommend this portable vapor degreaser for flushing out the engine crank case, probably because the vapor would condense before reaching the extreme ends of a cold crankcase. END

Fluorescent Strip on Bridge Rail Lights Road

A CONTINUOUS row of 8-foot fluorescent lamps along one railing of this bridge at Salem, Mass., throws light over the entire 32-foot roadway and the sidewalk at right. The experimental installation, by Sylvania Electric Products, lights a 500-foot section of the bridge so well that motorists can drive over it at night without headlights.





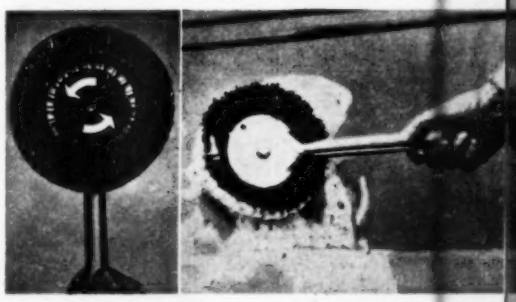


Crankcase Ventilator Filters Vapor Impurities

THE Vacu-Vent®, recently introduced by Motor Economy Products, New York, is said to reduce engine wear by filtering gaseous impurities in the crankcase and introducing the cleansed vapors into the intake manifold. Vacuum in the manifold actuates an air-valve piston in the device, creating a corresponding vacuum that draws out the crankcase vapors. Savings in gas and oil consumption are claimed for the ventilator, as well as increased engine power. It sells for about $17 and can be installed in under an hour.

Water Makes Car Brush Revolve

A REVOLVING brush driven by either high or low pressure through a garden hose takes some of the work out of car washing. A stationary bumper brush reduces splashing and enables you to clean corners. The Swirl-O-Matic®, sold by Melaire Distributing Co., New York, is priced at about $7. Replacements for both brushes are also sold. The scrubber can be used for cleaning screens, walls, and other large surfaces.



Pet Rider Gets Window Seat

LATEST thing in animal riding comfort is this portable, padded, railed window seat invented by W. W. Casteel of San Diego, Calif. It is a 20" diameter semicircle that hooks into the window well to give pets more air and a better view of the scenery.

Mirror Locked by Door

A REAR-VIEW mirror being distributed by Ford dealers hooks onto the door top so that it can't be stolen when the doors are locked. Only one screw clamp is needed for the installation. Angle of vision is adjustable from inside the car.

Gus Turns

When Stan came back with the torch and solder, Gus had hacksawed the tube at three spots.

— RAY QUIGLEY —

the Heat Off

The heat was on in more ways than one. A used-car dealer started it when he told his young salesman to deliver or else, and an old sedan kept it going until Gus cooled things off.

By Martin Bunn

STAN HICKS bustled into the Model Garage office. Gus Wilson, puffing his pipe, was checking over a stack of accounts with his partner, Joe Clark.

"Boss," Stan broke in, "you know—"

"I'm busy," Gus said without looking up.

"But Boss," Stan persisted, "you know Lem Spardom?"

"No, and I'm still busy," Gus said shortly.

"Aw, have a heart," Stan begged. "Lem's in trouble. He's really up against it now."

"You'll be up against it yourself if you don't stop bothering me," Gus said sternly. He winked at Joe Clark.

"But Boss . . ." Stan pleaded.

"Okay, okay," Gus grinned, pushing a stack of papers aside. "What's the trouble?"

"It's like this," Stan began. "Lem was in my class in high school. Now he's a salesman for Snedicker—that used-car dealer down the highway. Lem did all right for a while but he ain't been doing so good lately. Snedicker told him he'd cut off his drawing account if he didn't sell a car this week."

"That's tough," Gus said.

"That ain't all," Stan went on. "This is Saturday afternoon and it's still no sale for Lem. And he's got a wife and kid to take care of, too."

"That's also very tough," Gus said, "but we're running a garage, not a personal-problem clinic for used-car salesmen."

"Aw, Boss . . ."

"Seriously, Stan, what can I do about it?" Gus asked, dropping his hardboiled pretense.

"It's this way," Stan sighed. "Lem's got a car he can sell this afternoon if one thing is repaired. The temperature gauge keeps climbing over into the red. This man told Lem he'd buy the car if it was fixed by four o'clock and you said it was fixed."

"It's after three now," Gus said.

"I know it," Stan said, "and selling this car is Lem's last chance to hang on to his meal ticket. Otherwise, this customer'll go to another dealer."

"All right," Gus agreed. "Where's this car with the climbing temperature gauge?"

"In the shop," Stan said, "and I don't know

why it should be climbing so high. The water in the system's not very hot."

"I'll be with you later, Joe," Gus told his partner.

Stan led the way to the shop, where Lem Spardom, a studious-looking young man, stood beside a 1941 sedan. He seemed worried. Gus shook hands with him and glanced at the instrument panel. The temperature gauge showed over 200 degrees. Gus stepped around and looked at the engine. He noted that the fan belt and radiator hoses were new.

"See you been having some work done," Gus said.

"Quite a bit," Lem answered. "When our mechanics went over this car they found someone had removed the thermostat. After they put in a new one, the gauge indicated overheating."

"They use the right one for this model?" Gus asked as Stan let the radiator drain.

"They tried two or three different ones, checked and rechecked them but couldn't get anywhere. Before they got through, they put on a new water pump, installed those hoses, reverse-flushed the radiator, and put in cooling-system solvent."

"And it still overheated?" Gus asked.

"The radiator never boils," Lem went on, "but every time you look at the gauge you think it's about to. One of the mechanics wanted to take the thermostat out and just not say anything about it. I couldn't see that. It looked like a dirty trick."

Gus Finds the Hot Spot

"It would have been a dirty trick," Gus agreed. "Yanking the thermostat looks like an easy cure for overheating. Actually, it just covers up the cause of it for a while."

"Well," Lem said, "I don't know about thermostats, but I figured that if the manufacturer put one in, it ought to stay there."

"That's right," Gus said. "Pull one out and you pay for it sooner or later in increased engine wear and higher gas and oil bills. A thermostat temporarily blocks water circulation to let the engine build up to normal running temperature fast. Gasoline vaporizes and oil circulates much better in a warm engine. After she's warmed up, the thermostat lets the water circulate."

"Maybe the temperature gauge is out of whack," Stan suggested.

"Could be," Gus agreed.

"Or the heat-indicator unit on the engine," Stan added.

"Could be that, too," Gus said. "We'll check those two points first. Get me a pan of water, Stan."

Gus removed the heat indicator unit and examined it closely. Then he put the pan of water on a gas ring. When it boiled, he dropped the unit—still connected to the gauge—into it. The gauge promptly registered boiling.

"Right on the nose," Gus commented. "The unit and gauge seem to be okay."

"Now we're right back where we started from," Lem shrugged.

"Oh, it's not that bad," Gus said. "I think I know what the trouble is—maybe. Get busy and take off the water pump, Stan."

Gus stepped to his workbench, selected a welding rod, and shaped one end into a small hook. Stan removed the pump, revealing a hole into the block where the pump had been. Gus poked the hooked end of the rod into the hole and yanked. Nothing happened. He pulled again, but still nothing happened.

"I get it," Stan said suddenly. "I ought to have thought of it before. Wait a minute." Stan hopped to the bench and came back with a hammer, a small chisel, and a hacksaw.

Gus grinned. He took the chisel and hammer and spent a minute tapping gently around the circumference of the hole. Then he again pushed the hooked rod into the hole. This time he slowly withdrew a few inches of badly rusted oval tubing.

"What's that?" Lem asked.

"The water-distributing tube," Gus said. "It runs lengthwise through the block inside the cooling jacket. It carries the incoming cooler water from the radiator directly to the valves and valve seats. Keeps them from burning and lengthens their life."

"I didn't even know there was such a thing," Lem said.

"Most car owners don't either," Gus told him, "and some mechanics have a bad habit of forgetting. Every L-head engine built since 1935 that has a water pump in front—except V-8's—has one. Before water goes to any other part of the engine, that tube carries it right to the valves."

Gus pulled out a few more inches of the tube and cut the bottom almost through with the hacksaw. Then he bent the section upwards. He continued to pull out the tube, cutting and bending as he went along, until he had removed its entire length. Much of the tube's bottom and sides had been eaten away by rust.

"There's the cause of your trouble," Gus said. He held the tube up. "This should have

been replaced a couple of years ago, anyway."

"I don't get it," Lem said. He stared at the corroded tube Gus held. "You mean that rusted tube makes the temperature gauge run up high?"

"That's right," Gus said. "It's so rusted that it couldn't carry water where it should. So you had a localized hot spot where the heat-indicator unit is located on the engine. A new tube will fix it."

The Heat's Off

"Well, that's fine," Lem said, still a little doubtfully, "but I've got to deliver this car in a little over half an hour or I can drive it right back to Snedicker."

"Gee, Lem," Stan said, "can't you get this guy to wait? We'll have to pull the radiator to get the new tube in. That'll take too long."

"If that's the case, I'm sunk," Lem said. "This man said to bring the car and no overheating by four o'clock, and he meant it."

"That's too bad," Stan sympathized, "but we'll have to pull the radiator. The new tube's too long to get between it and the block. Then we got to put it back."

"Maybe we can beat the deadline," Gus grinned. "Get a new tube from the stockroom, Stan, and make it fast."

Stan made it fast, but when he returned with the tube he found Gus methodically filling his pipe while Lem hopped around impatiently. Stan wondered why Gus wasn't working on the grille.

"Want me to take off the grille?" Stan asked.

"Never mind the grille," Gus answered. "It can stay right there. We're going to shortcut this job. Let's have that tube. And get me a torch and some solder."

Gus is one of those expert mechanics who talk slowly, never seem to be in a hurry, but work fast. By the time Stan came back with the torch and solder, Gus had hacksawed the new tube three-quarters of the way through at three points. He bent the sections around and pushed the first one into the hole in the block almost as far as the cut. Then he bent down the next section and soldered the cut. He pushed that section in and soldered the next cut. Working that way he had the new tube installed in less than 10 minutes.

"There you are," Gus said, straightening up from his work. "Almost set to go and we didn't have to touch the grille."

"That's swell," Lem grinned, keeping an eye on the clock.

"Put the water pump back on and fill up the radiator," Gus told Stan.

Stan jumped to his work. "If you didn't do that cutting and soldering, what a job that could be on some models—those that have the grille and fenders as one unit."

"I don't know how to thank you," Lem said. He stuck out his hand. "You sure saved my skin."

"Forget it," Gus answered.

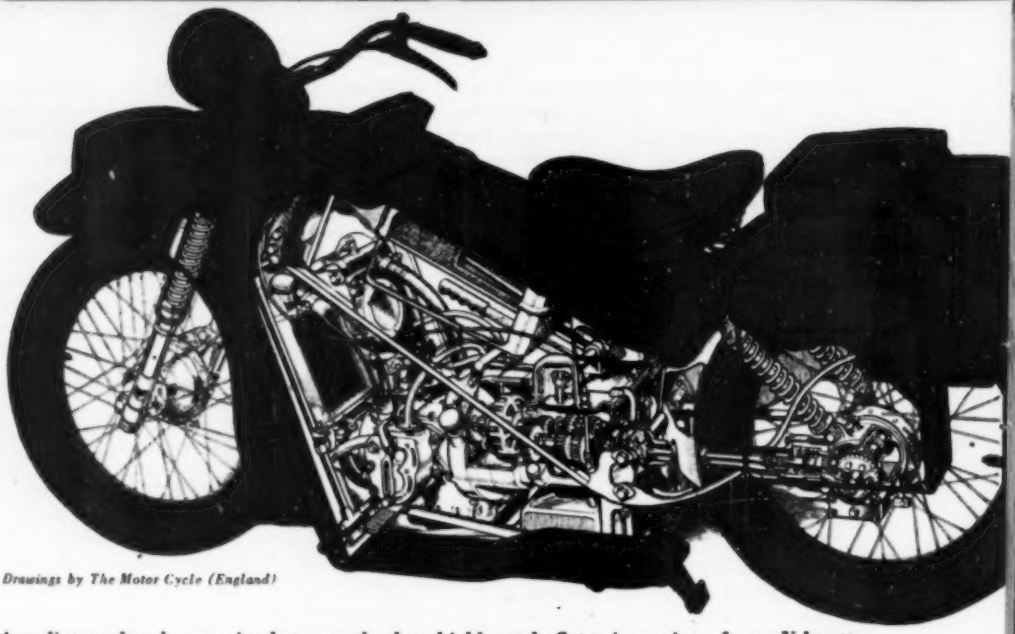
"I'll drive by later and take care of the bill," Lem said, climbing into the car.

"You can tell your customer that the overheating is cured."

Stan filled the radiator and Lem drove out. "Gee, Boss," Stan told him, "you sure deliver when the heat's on."

"Hey, Gus!" came a sharp yell from the office. "Will you for gosh-sakes come back and finish these accounts with me?"

Gus grinned at Stan. "The heat's still on. What I better do is deliver now, before Joe starts steaming." END



Drawings by The Motor Cycle (England)

A radiator placed crosswise between the leg shields cools flat-twin engine of new Velocette.

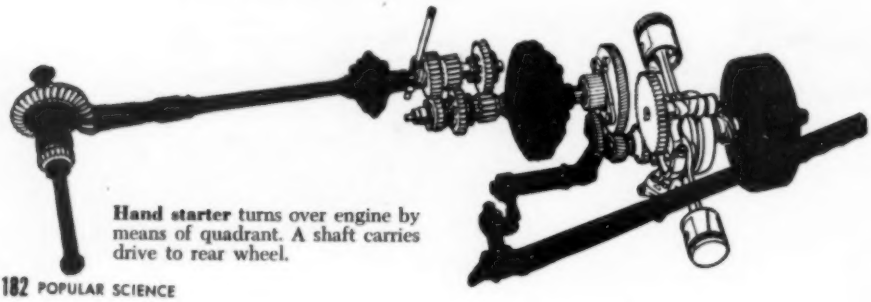
Water-Cooled Motorcycle Starts by Hand

WATER cooling, a hand starter, and a shaft drive are among the features you'll find in the new lightweight Velocette 149, a British motorcycle of striking appearance that's soon to reach the U. S. market. It's powered by a transverse, horizontally opposed twin engine with side valves.

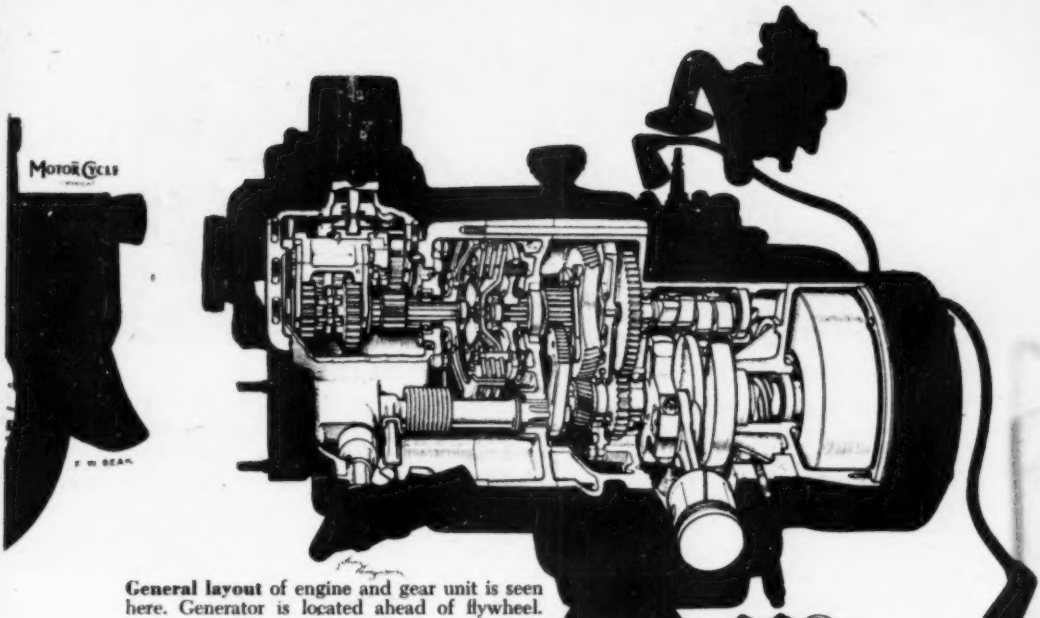
Although piston displacement is only 149 cc. (9.08 cu. in.), the engine is reported to have plenty of umph. It has a comfortable top speed of about 50 m.p.h. and runs with a sewing-machine hum. In this country, the 264-lb. machine will sell for about $432.

When pulled, the starter handle partly rotates a fore-and-aft shaft. Splined to this shaft is a quadrant that engages a small starter pinion. By means of two pawls, the small pinion rotates a large primary reduction gear, which in turn rotates the engine. The starter handle also raises a prop stand fitted under the footrest on each side.

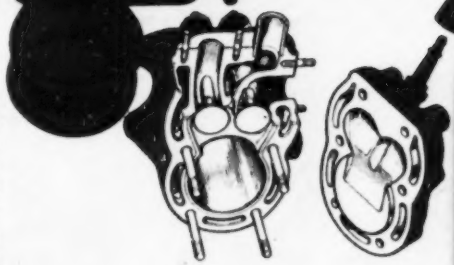
Gears are shifted with a hand lever set in a gate above the starter lever. The gear box provides three speeds. A handle-bar lever controls the clutch.



Hand starter turns over engine by means of quadrant. A shaft carries drive to rear wheel.



General layout of engine and gear unit is seen here. Generator is located ahead of flywheel.

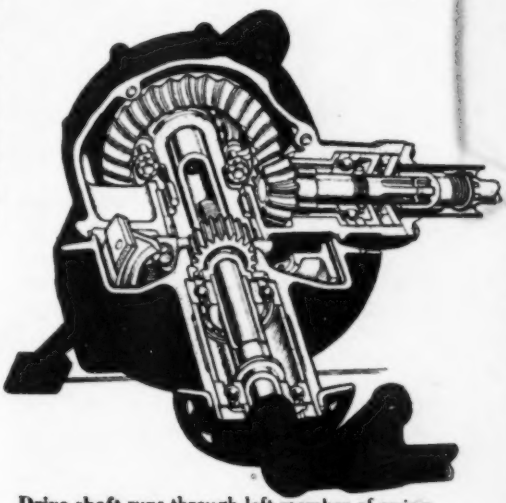


Because of a low center of gravity, low-speed balance of the machine is said to be exceptionally good. The front suspension is a telescopic fork with coil springs, the rear a swinging arm with coil springs that are adjustable for load. The frame backbone is sheet steel, bent down over the sides.

A two-throw crankshaft is employed. This is carried on four main bearings. A gear for driving the camshaft is splined on between the two rear main bearings. Running on two ball bearings, the camshaft is immediately above the crankshaft.

Splined to the tail end of the crankshaft is the primary drive pinion. This engages the large primary reduction gear. Mounted on the end of the primary reduction-gear shaft is a two-plate dry clutch, followed by the transmission. An air cleaner is fitted behind the top of the radiator (see below).

The rear suspension consists of a pivoted horizontal fork, coil springs. Top lever shifts gears.



Drive shaft runs through left member of swinging rear fork. Note brake opposite the gears.

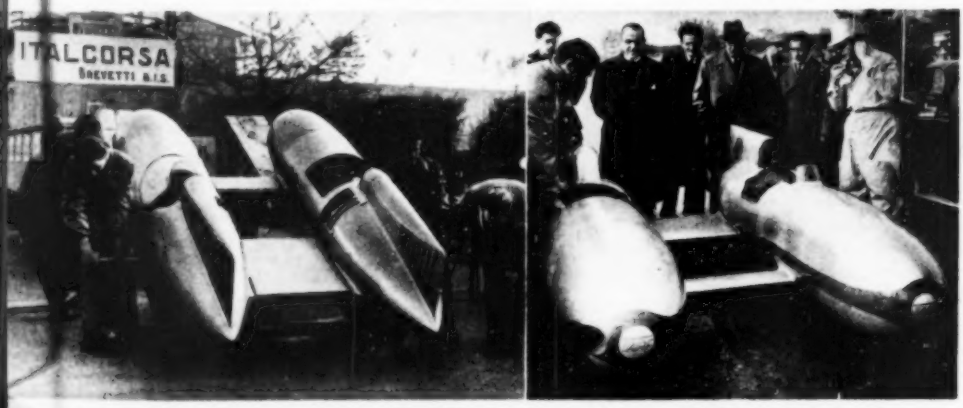
Low-Cost Convertible Offers Big-Car Styling

SHOWN above is the convertible model of the Morris Minor, a small British car now being imported into the United States. The convertible sells here for about $1,600.

It's powered by a compact four-cylinder British Bulldog engine that delivers 27 hp. The engine sets well forward, allowing all passengers to ride within the wheelbase.

Like its hard-top counterpart, the convertible has a wheelbase of 86". The overall length is 147½", width 60", and height 58". The convertible top is raised and lowered by hand. Rear side windows are removable when the top is down. The pull-type door handles are flush fitting.

In keeping with British custom, the car has four forward speeds. Gears are shifted with a floor lever. Top speed is about 60 m.p.h. The car is said to give 35 miles per gallon, even in stop-and-go traffic.



Double-Barrelled Car Sets New Speed Records

FIVE world speed records for cars with 500 cc. (30.5 cu. in.) engines have been established in Italy by this twin-fuselage racer, designed and driven by Piero Taruffi. Highest speed was 128.8 m.p.h.

Streamlined to cut down air resistance, the car has vertical fins to increase stability. The driver sits in one fuselage, and the other carries the engine and fuel tank. The engine is a V-twin, air-cooled, unsupercharged Guzzi that develops 45 hp.

Chains from a four-speed gear box drive the rear axle, housed in a streamlined cover between the fuselages. Gears are shifted hydraulically by means of a lever between the driver's knees. Engine controls also are hydraulically operated.

Instead of a wheel, the car has two levers for steering. These move back and forth like steering controls in a tank. One turns the car to the left, the other to the right. All wheels are independently sprung. Brakes are operative only on the rear ones. The entire machine weighs only 551 lb.

Taruffi hopes to build a larger car of the same type to race at Indianapolis.

1. Jack up the car. That's the first step when tires or tubes are fixed at the General Tire shop in New York without removing wheel from car. The jack lifts two wheels off the ground.

How an Expert Fixes a Flat

In this shop, they do the job without taking the wheel off the car—and they can do it in less than four minutes.

By R. P. Stevenson

PS photos by W. W. Morris

ONE day this spring a motorist drove into a tire shop on New York City's West Side. His car was secondhand, a recent purchase. Its rubber seemed good but he wasn't sure about the tubes.

Two tire men went to work when he ex-

2. Break outer bead. After letting out the air and sloshing liquid soap around rim and bead, mechanic frees outer bead with tire iron and hammer. Hammer never hits side wall, however.

3. Now free the tube. With the outer bead off the rim, he stretches tire toward himself to pull valve stem from the rim. He also checks to make sure tube isn't sticking to the rim.

4. Loosen the back bead. Several hearty tugs loosen the inside bead and it's then an easy matter to pull tire from the rim. Entire job up to this point took 1 min. and 40 sec.

5. Put in the tube. After being given a shot or two of air, a tube is shoved into casing. Mechanic's weight spreads tire enough so he can put in ordinary tube without difficulty.

plained that he'd like to check the tubes. One slid a hydraulic jack under the frame at the middle of the car and tilted it, raising a front and rear wheel off the ground. The other got together a few tire irons, a couple of hammers, and two battered old cans—one containing liquid vegetable soap and another filled with a greaselike substance.

Then both turned to the wheels, one at the front, one at the rear. Not bothering to pry off the hub caps or unscrew the lugs, they let the air from the tires, made a few passes with a tire iron, and dragged off the casings—leaving the wheels on the car.

With the casings and tubes inspected and a new tube installed, the tires were mounted again in a jiffy. After a repeat performance on the opposite side of the car, plus similar attention to the spare, the job was done.

Just a little more than ten minutes after entering the shop, the motorist drove away.

Such speedy service is a common occurrence at the shop of the New York General Tire Company. The secret lies in the fact that the job is done without removing the wheels from the car.

The procedure was adopted during the war, when both time and help were short. It proved such a time-saver that the company made it standard practice. Today, mechanics at the shop take pride in the speed with which they do the job.

At the outset, other tire men threw up their hands, said it was a bad idea. How could you, they asked, remount the tire without pinching the tube?

But General does it. In the years the shop has been mounting tires in this way there have been only a couple of returns for failure because of pinched tubes.

You can see how it's done in the accompanying series of photos. If you're an old grunt-and-strain tire hand yourself, it may be a surprise to learn that the job is done with such little effort and so few tools.

There's no reason you can't do the same thing yourself. Here's one caution. Be sure you have a good jack, one that will let you exert pressure without knocking the car down on your toes.

The General shop has elaborate equipment and labor-saving tools, as the photos on page 188 show, but the quick-change job is done with just the things that any motorist might lay his hands on.

In this, you have the key to the character of a real expert. He uses his tools, but doesn't depend on them to do the whole job. To the tools, he adds the skill of his hands and feet—plus a liberal amount of common sense.

In the quick-change tire job, these are exactly the ingredients you'll find. Taken together, they add up to a task well done.

6. Apply lubricant. A vegetable compound in paste form is applied to tube and bead with a brush. Acting as a lubricant, this allows the tube to seat properly, prevents rust on rim.

7. Pry on back bead. A tire iron quickly slips the inside bead over the rim after the valve stem has been lined up. When bead is on, the mechanic starts the stem through its hole.

8. Heave ho—and it's on. Here's the key to the job. Using one iron, plus knee and arm pressure, mechanic quickly works bead into its well. He presses with knee while turning tire.

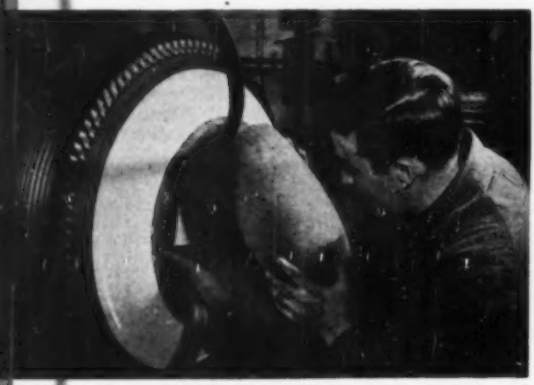
9. Some air, and job's done. Holding the stem with his thumb, he puts air in the tire before removing jack. This job took less than 4 min. Some mechanics in the shop work still faster.

Tire spreader operated by air pressure pulls the side walls far apart. With a used tire, this enables the mechanic to spot any cuts or breaks in the fabric on interior of the casing.

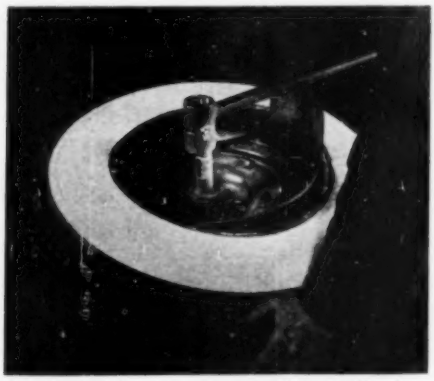
Specialized Tools Aid Tire Mechanics

ALTHOUGH changing a tire without removing the wheel saves time, it's sometimes necessary or convenient to do the job the old-fashioned way. At the New York General Tire shop, however, you'll find equipment that's anything but old fashioned.

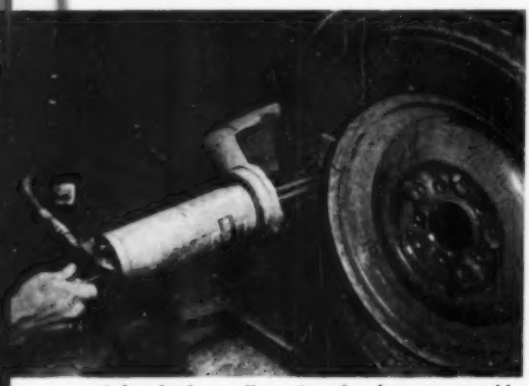
Some of the shop's labor-saving tools are shown in these photos. Several are used in almost any tire shop. Others are not so common. In addition, the General shop has complete equipment for balancing wheels, an important step in these days of lower tire pressures. And for truck work, there's a big air hammer to loosen stubborn beads.



Spreader also is used for easier insertion of the puncture-proof tube made by General. This tube is much heavier than the ordinary type, and it's difficult to insert in usual way.



Greasy hands never touch white wall when the mechanic uses this tool. It consists of pedestal with a shaft to hold wheel. Turning the guide once around slips the bead on the rim.



A bead "frozen" to rim after long use quickly yields to this air-operated tool. As valve is turned on, a pressure foot kicks tire inward. Several strokes around the tire loosen bead.

Torsion wrench turns up the lugs to an exact tightness. They're tight enough to be safe, but still can be loosened with an ordinary lug wrench if you're caught with a flat. END

Mechanics and Handicraft

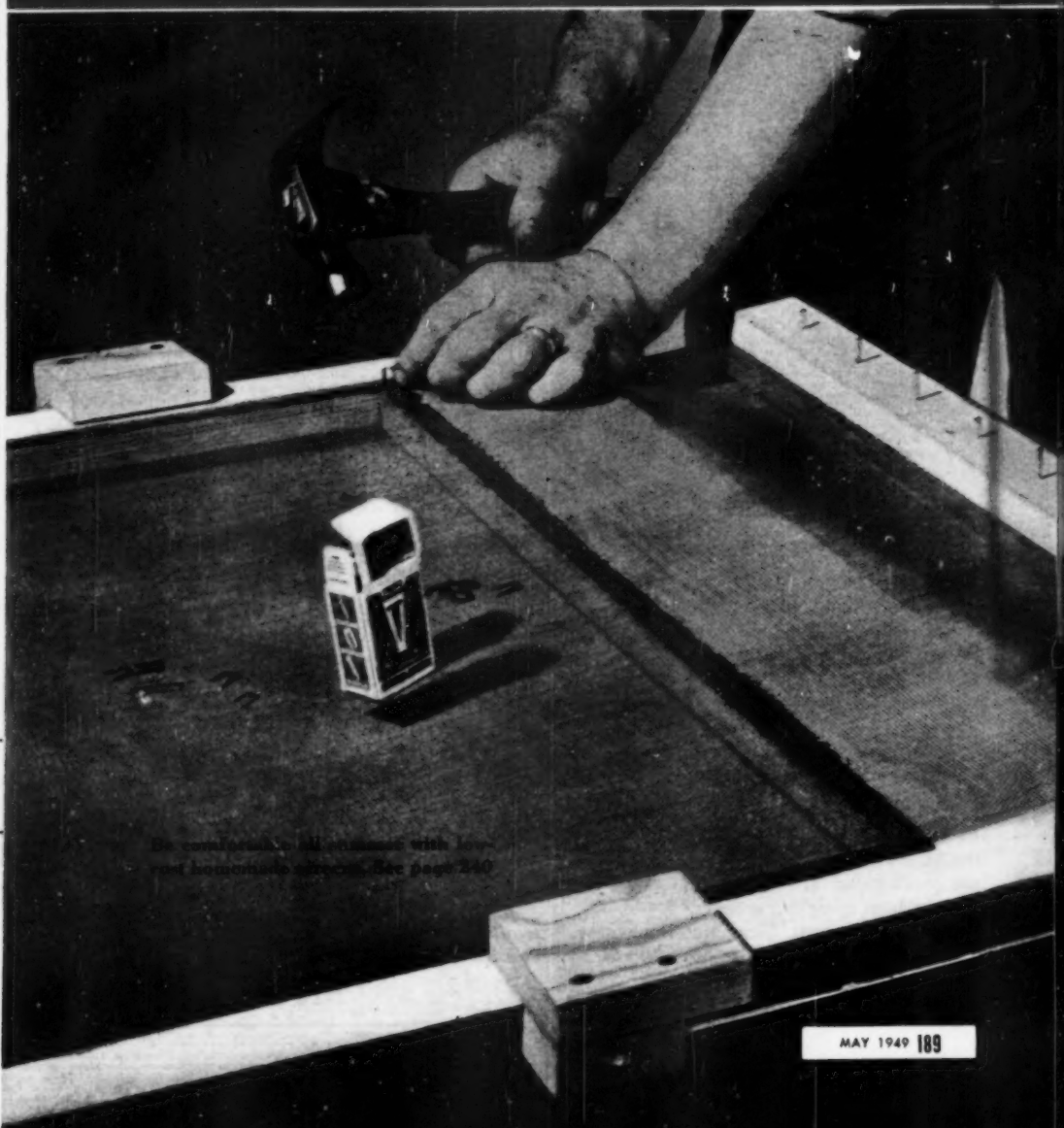
New Screens at a Saving PAGE 240

Chests from Orange Crates PAGE 196

Quick-Heat Soldering Iron PAGE 214

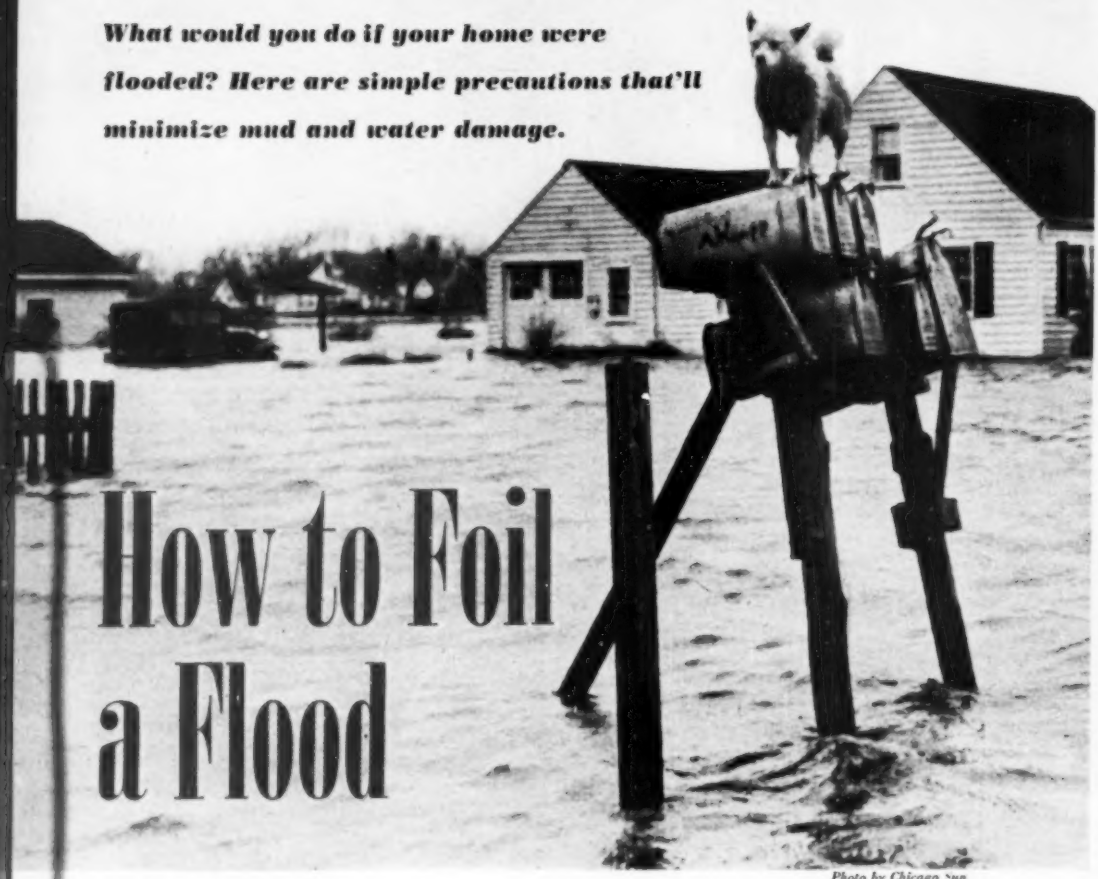
Copying Without a Camera PAGE 222

4-Way Radio Saves Batteries PAGE 227



Be comfortable all summer with low-cost homemade screens. See page 240

What would you do if your home were flooded? Here are simple precautions that'll minimize mud and water damage.



How to Foil a Flood

Photo by Chicago Sun

By Volta Torrey

YOU'VE seen a lot of photos of other people's homes half submerged by swirling, muddy flood waters. A great many of those persons never expected the water to flow over their window sills. So they made mistakes that increased their losses and suffering.

That need not happen to you. All by yourself, you probably can do more than you suspect to foil a flood. Of course, you can ask your insurance agent about coverage for flood damage, but you are liable to find that it would cost a wad of money. There are precautions, nevertheless, that you can take without spending a cent.

Just ask yourself these questions now:

How high would water have to rise to reach your home?

Most floods can be seen coming. Government engineers frequently can predict the height to which a river will rise 24 hours in advance. But much property is lost in almost every flood because people fail to understand the warnings. They don't know whether or not a flood cresting at the number of feet specified in the warning will affect their homes.

In many communities, the Red Cross has prepared maps that show what streets and lots will be covered if a river rises 20, 25, 30 feet, and so on. By consulting such a map now, and remembering the stage at which the water would hit your home, you may save yourself a lot of time and trouble.

Which way would you go, and what would you take with you, if a flood were coming?

Never plan to sit out a flood on the second

floor or the roof. That's the way lives are lost. You can usually escape a flood, without even getting your feet wet, if you start in time and know where you're going. Consult the Red Cross now if you are uncertain.

There usually is time enough, if you understand the warnings, for you to remove the things you'll need for your children and yourself. Forgetfulness, though, may be as annoying as the water. Pack your bags as though you were leaving for a vacation. Take your good clothing and toilet articles.

After you've removed the things you'll need most, think of the articles you'll want first when the water recedes. Take your washing machine, if you can—and shovels, rakes, mops, brooms, and boots. Toss a sack of clean rags in your car, too, because the demand for them probably will exceed the supply after the flood.

Then ask yourself: Are there heirlooms or other things dear to you that never could be replaced? How about your deed, military-service papers, war bonds, jewelry, musical instruments? And don't forget your glasses.

What would you do before the flood to minimize damage?

People who know what floods are like can accomplish an astonishing amount of work before the water begins to lap at their doorsteps. They lug their canned food, and everything else that's movable and valuable, up out of the basement. They douse the fire in the furnace and shut off the utilities at the mains.

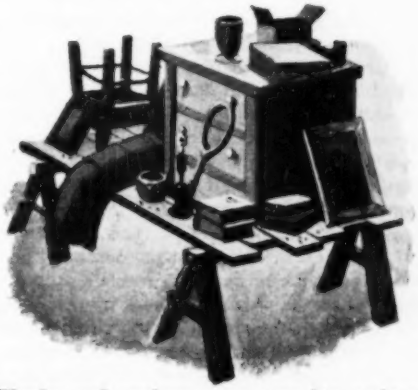
Then they start with the first-floor rugs and move everything possible to the second floor or attic. Even a small attic will hold an amazing number of articles in an emergency. And what's left often can be stacked on a scaffold made by placing planks across sawhorses or sturdy boxes. Contrary to some folks' opinion, shifting the weight upward in a house does not increase the danger that the building will be washed away.

Experienced flood fighters hoist up the radio and the veneered or plywood furniture before they struggle with solid pieces, since the latter are less susceptible to water damage. They are careful not to place rugs or heavy articles on frail tables or wooden beds that might collapse. They stack their dishes and pots and pans in baskets, and put these, along with drawers of linen and clothing, in the highest possible places.

Finally, they open the windows wide and prop the doors open firmly. This makes

After you've removed immediate necessities from a flood-periled home, move everything possible to the attic or an upper floor.

Rubber hose or a piece of roofing over the teeth of a rake makes an excellent squeegee for shoving mud out of a house.



Planks and sawhorses, or even big packing boxes, make good platforms to hold pieces of furniture out of reach of the water.

it as easy as possible for the water to flow through the house. There's likely to be only about a tenth as much mud left in a house that is wide open as in one that is closed.

What's the most sensible thing to do while flood waters are pouring through your house?

Get plenty of rest.

If you wear yourself out running around or rowing around just to see what's happening, you'll regret it later. The best course is to report immediately to disaster headquarters, and take whatever inoculations or other health precautions are recommended. Don't linger in a danger area, no matter how exciting it seems. That's the way people get hurt.

Don't wade back to your home until you're sure you can get both to it and from it safely. Then take a broom or long stick and keep poking the ground ahead of you. The flood may have washed out ugly holes, even in pavement and sidewalks, and you may get a nasty fall. Don't wade around barefooted; there's likely to be broken glass in the muck.

Never enter a building that has been flooded without first making sure that it won't collapse. Even if it still seems solid, proceed cautiously. You might get hit on the head by a chunk of falling plaster. There's no telling what you'll find. When Red Cross workers entered one home after a recent flood, they found a cow on a bed.

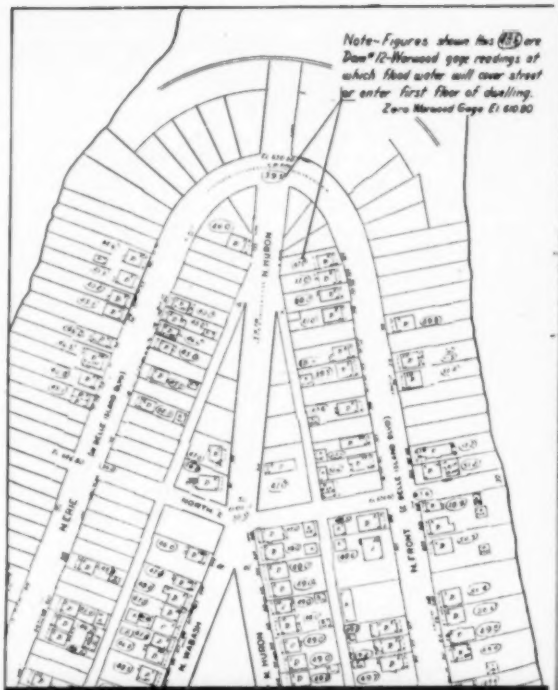
How would you clean up several inches of mud in your home?

Cleaning up after a flood is an appalling job—but some ways of doing it are not so difficult as others. Don't be discouraged by the odor. The wind usually will take care of it if you keep the house wide open.

If a door will not open normally, remove the hinge pins and shove it out. If the windows are so swollen that you can't move them, take out the sashes and lift them out.

Carry everything you can out of every flooded room. Then, if you have a source of water and a hose, wash the mud out the way you'd wash a street. You can make an excellent squeegee by putting a section of rubber hose, or a strip of roofing, over the teeth of a rake or the edge of a snow shovel.

Take up linoleum immediately so mud and water won't remain under it. Remember, too, that it's cheaper to repaper a wall than replaster it. So don't try to save badly soaked and soiled wallpaper. Pull it off wherever it's loose. Do this gently lest you



Block maps like this, show at which stages flood waters will surge into each dwelling.

loosen the keys that hold the plaster to the laths.

Your floors and woodwork are likely to buckle or warp if they remain wet very long. But by removing the mud and exposing the wood to the air, you can reduce the damage. A buckle in a floor sometimes can be face-nailed down and mended later. Don't attempt permanent repairs while the wood is still damp.

Should you immediately fire up the furnace to dry things out?

You shouldn't—until you're sure it can be done without damaging the heating plant. Flood waters are likely to leave silt everywhere, and mud in the flues or passages might cause your heater to burst. Clean them carefully with a hose or a swab on a long stick. Take the smoke pipe out of the chimney, too, and reach through the thimble to remove any mud that may have settled there.

Look your chimney over carefully, too. The water may have eaten away mortar between bricks, leaving openings that

Can this happen to your home? Thick layers of smelly mud coat the floor of this wrecked house in Montrose La Crescenta district Los Angeles County. Water smashed furniture through wall.

should be repaired. Most chimneys stand on foundations in the ground. These should be checked to see if there has been undermining.

If you have an oil-burning system, make sure water and dirt haven't gotten into the tank. Dismantle the burner and clean all parts with gasoline or kerosene. The air blower and fuel pump should be cleaned too. You may discover, even in gear housings that seem tight, that mud has seeped in.

Finally, when the system can be started safely, be careful not to overheat a damp house. That might release vapor that would actually delay the drying.

What would you do about wiring and household mechanical equipment?

Utility companies have to be cautious about restoring service after a flood. Don't demand that they endanger your own or other people's lives. All wiring must be checked. All motors, pumps, washing machines, sewing machines, and other mechanical equipment must be taken apart, thoroughly cleaned with gasoline or kerosene, and dried. Windings should be baked in a slow oven and carefully tested for shorts.

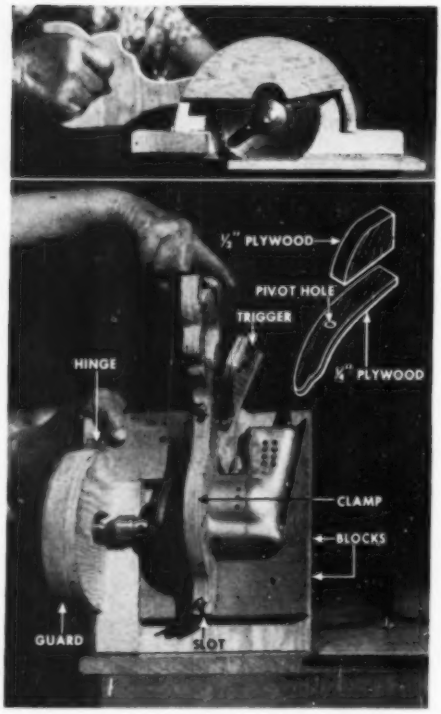
What should be done with furniture?

Take all wet furniture outdoors as quickly as possible and remove all movable parts such as drawers. Don't try to pry out stuck drawers. Remove the back and push them out. Next, clean the furniture and store it. Leaving it in the sun may cause warping.

Books are very difficult to save. Stand them on end with the pages open. As soon as they have dried a bit, stack them to prevent the paper from crumpling. Then stand them on end again. You may save them by such alternate drying and pressing.

Could you intelligently direct strangers willing to help clean up?

Americans are quick to lend a hand after every disaster. Volunteers, eager to work, show up before the victims have decided what to do first. Much of this labor is wasted when home owners aren't prepared to direct it intelligently. So look your home over now to see what you'd do and how you'd want it done if a flood comes. END



Converting Drill to Saw

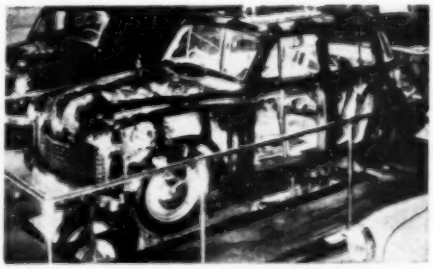
HELD fast in a frame with a 4" circular saw in the chuck, a ¼" electric drill becomes a very useful portable electric saw. I've found it particularly handy in cutting up large plywood panels.

No dimensions are given since drills vary in size and shape. Lay the drill on a bottom piece of ¼" plywood so the chuck extends beyond an edge. Be sure the spindle is parallel to the bottom, and at 90 deg. to the edge. Screw short lengths of 1" by 2" stock to the base to locate and hold the drill housing accurately. Cut a clamp from ¾" plywood to fit the contour of the drill. Bore the clamp for two stove bolts and wing nuts. Shape one end of the clamp like a saw handle. Make the guard of ¾" and ¼" plywood, securing it at one end with a small butt hinge. The trigger is another piece of plywood, pivoted on a stove bolt. The thumb of the same hand that holds the saw can operate the trigger. A threaded shoulder arbor holds the saw blade in the chuck. Mount the blade so it cuts from the bottom up instead of from the top down. With my drill mounted on a ¼" base, a 4" blade has a ⅜" depth of cut. A 1/16" sheet steel base gives a ½" cut.—*Pio Panieri, Roslyn, Wash.*

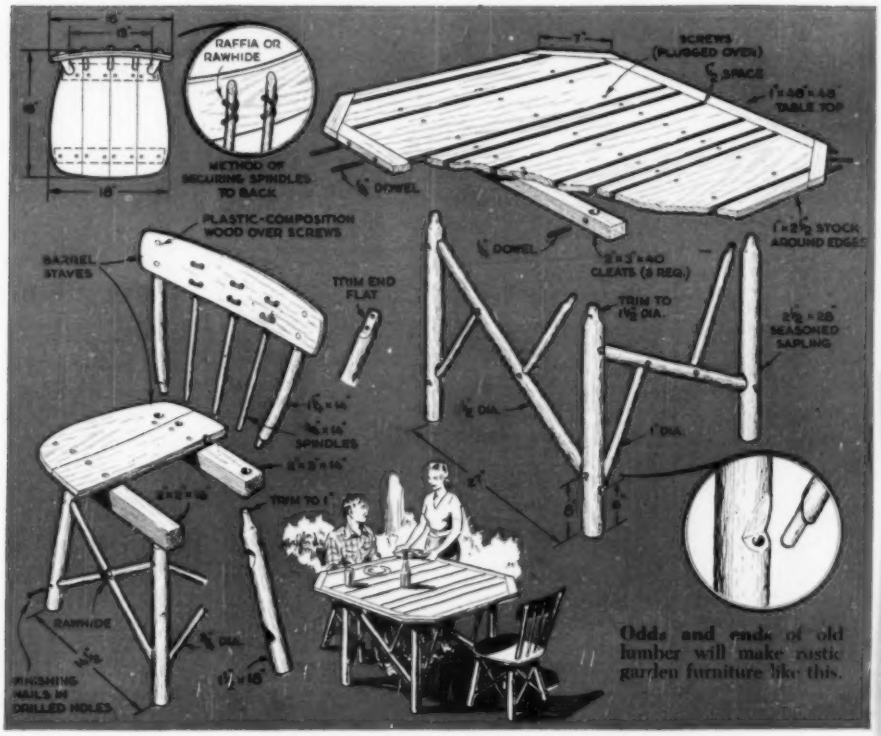
Bags Protect Clothes

TRANSLUCENT Vinylite® bags keep clothing fresh and clean on auto trips. Hung in the car, the dustproof zippered bags can be moved right from the car to a hotel room. The retail price is about $1.60. Keko Products Division of Kennedy Car Liner & Bag Co., Inc., of Shelbyville, Ind., is the maker.

Transparent Car Exhibited



Now touring the United States is a full-sized plastic and steel model of a new British car, the Hillman Minx. Many of the car's moving parts can be seen in actual operation through the transparent plastic. The model, being displayed by Minx dealers, was built by apprentice engineers. Smaller than the average American car, the Minx is a 4-cylinder sedan.



Odds and ends of old lumber will make rustic garden furniture like this.

Furnish Your Garden with Saplings and Staves

RUSTIC garden furniture comes high these days, but chances are that you can beat those costs with odds and ends from almost any woodpile. Old boards from a fence or shed, for instance, will do nicely for the top of a weatherproof table, while barrel staves can be turned into backs and seats of chairs.

Use any available 1″ boards for the table top; random widths add to the informal effect. Space them ½″ apart on three 2″ by 3″ cleats. None of the cleats need be finished lumber. You may wish to plane down the boards of the top, though. Drill two of the cleats for the tops of the legs.

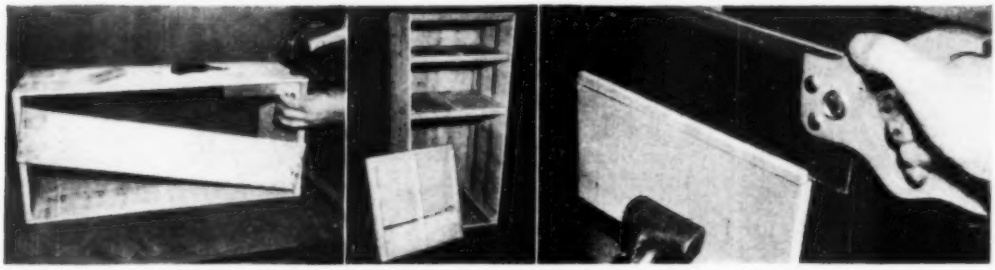
Screws that go through the top boards are countersunk and plugged over with dowels. The border pieces are secured with dowels. Cutting away the corners eliminates sharp points that serve no useful purpose anyway.

Construct the legs and bracings of seasoned saplings. Green wood will shrink and the joints will loosen. When you assemble the parts, use waterproof glue at all points, including the dowels.

Barrel staves make comfortable seats and backs for chairs. If available, make the supporting posts of the chair backs of slightly curved pieces. Secure the spindles at the top with rawhide or raffia and fit them into holes in the seat at the bottom. Countersink the screwheads in the seat and back just enough to cover them with composition wood.

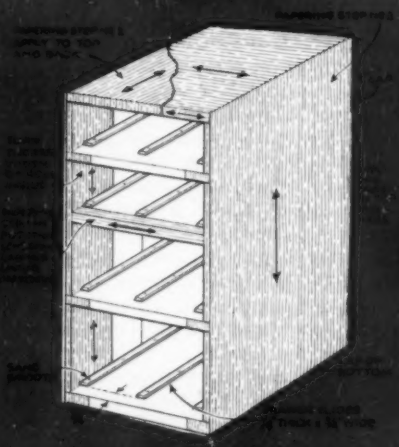
This type of furniture should not be painted. Just leave it out and the weather will mellow it. It's designed to take it and, as constructed, will not come apart. Skin the bark off the saplings before using them. Otherwise, they will in time present a scaly appearance.—*Hi Sibley, Nuevo, Calif.*

Heavy, washable wallpaper and a few hand tools transformed these discarded fruit crates into this set of matching chests. Such chests can be used individually, in groups, or stacked.



When you reassemble the crate lumber, butt the boards against each other. To aid in nailing on the ends, a sidepiece can be temporarily nailed in place to help keep ends square, as shown at left. Before installing the drawer partitions, nail and glue the slide strips to them, center. The rabbet joints where drawer fronts join bottoms can be made with a back saw.

Chests Start Life as Orange Crates



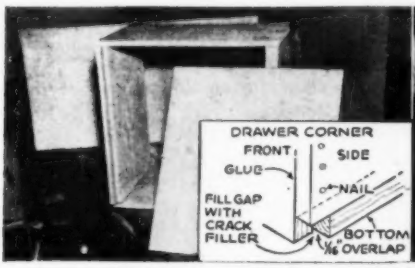
FRUIT-CRATE furniture needn't shout where it came from. Surprisingly attractive chests of drawers, for instance, can be built from beat-up orange crates. The trick is twofold: first you take them apart and rebuild them without cracks and gaps, and then you cover them with heavy wallpaper. With practically all store furniture a pain in the pocketbook these days, this stunt can save you plenty.

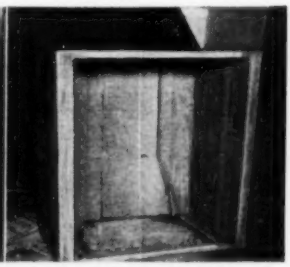
Disassemble the crates carefully with a claw hammer and a tack puller. Put the pieces for the top, bottom, and drawer partitions together. Size them alike, if necessary, with a saw and plane. Reassemble one crate without partitions and with the boards butted tightly against each other. A board nailed temporarily across the front will help hold the endpieces square while nailing the sides.

Before installing the drawer partitions, nail and glue three drawer slides to each one. Build the drawers to fit the openings, leaving 1/16" clearance on each side and the bottom. This allows for papering and necessary looseness. The rabbet joint where a drawer bottom and front join can be made with a back saw.

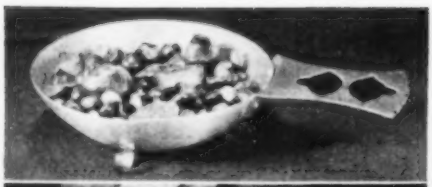
When drawers and frame have been completed, use plaster-type crack filler to plug all holes, dents, and cracks, first moistening the wood around the area. Let harden overnight and then sand smooth.

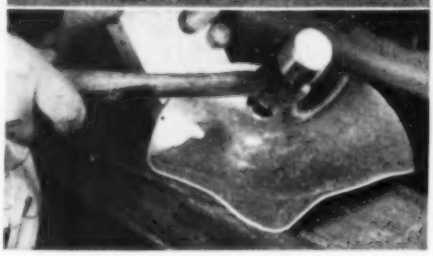
Now you're ready to paste on the wallpaper. Gummed paper is not recommended. Use regular wallpaper. One with a woodgrain design is especially suitable. In applying the paper, first smear the wood with a very thin paste mixture, and then apply paste-coated paper. Fit the hardware and let the paper dry. Finish with paste-type furniture wax.—*Robert E. Zuber, Philadelphia.*

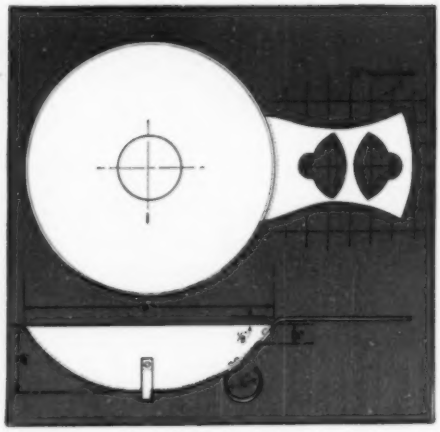




At left is an almost completed drawer with the bottom ready to be nailed and glued. After assembly, fill all cracks, dents, and holes with crack filler. Let it dry overnight and sand it smooth. Papering is the next step. Follow the drawing in applying the paper. Photo at right shows how drawer fronts and backs are each papered with one piece.







Porringer Hammered Out of Aluminum

THOUGH hammered out by hand, the bowl of this dish is finished in a smooth, spun-metal way that's usually associated with expensive pieces.

Use either .051″ or .064″ aluminum. Start by cutting a circle 7½″ in diameter. Use the same center to scribe another circle about 2″ in diameter as a hammering guide. Since I lacked a sandbag for a hammering base, I used a piece of fir four-by-four in a vise.

Hammer inside the 2″ circle until you have an impression about ½″ deep. This brings up the outer edge of the disk. Drill a hole through the center and fasten it to the four-by-four with a long wood screw. Later you can fill the hole with a rivet and file it smooth.

Use a backing block, as shown in the photo, and shape the base with a hammer. Strike it evenly and work regularly around the center. Symmetry of the bowl is more important than close adherence to the dimensions shown. After it's roughly shaped, remove the screw and hammer out any uneven spots. Then, with a bolt in the center hole, chuck the bowl in a drill press or lathe, being careful to see that it runs fairly true. Cautiously hold emery paper against the spinning bowl, moving it to cover the bowl inside and out. Stop and hammer out any spots that need it. Finish up with fine paper and then steel wool.

Cut out the handle, hammer the end to fit the bowl, and attach with rivets. Form the four legs from ¼″ by 2″ strips. Rivet one end of a leg to the bowl and then curve the leg around a piece of ½″ dowel.—*R. J. De Cristoforo, Bronx, N. Y.*

Automatic Pencil Records Inches and Fractions

As you roll the head of the Roller Rule® along a surface, the indicator on the shank records distance of travel up to 36″. Fractions of an inch, down to 1/16″, are shown on the head. The maker, Roller Rule Sales Co., Los Angeles, says the pencil works on both curves and straightaways and on hard or soft surfaces. Map mileages, pipe circumferences, and tailoring measurements are a few of its many uses. The instrument is made of black plastic with the numbers inset in gold color. Price is about $2.

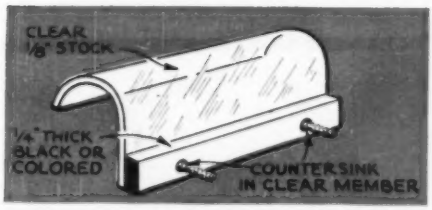
Plastic Pulls Give the Modern Touch

ACRYLIC plastics, with their characteristic sparkle, can add a decorative highlight to modern furniture. The drawer pulls shown here were created in the developmental studio of Rohm and Haas, Philadelphia, makers of Plexiglas®.

Turned handles are pictured above. The outsides are turned and polished and the insides are turned out to various shapes—a simple ring, multiple rings, or a center cavity. A center hole can be tapped for a mounting bolt, or the bolt can be set in plaster of Paris put in the cavity. Plaster turns the cavity white, making an interesting contrast with the crystal portion.

A shaped handle is shown in the lower drawing. It's formed from a blank about ⅛" by 3" by 6½". Cut it to shape, drill mounting holes, and heat in an oven until thoroughly soft. With gloved hands, shape the rounded portion about a 1¼" dowel or similar cylindrical surface, and the stand-off brackets over a rectangular piece of wood. Surfaces of the wood and dowel should be glass smooth to prevent printing off. If you want several pulls of this type, it'll pay to make the jig. Balsa is excellent for this.

A shaped two-tone handle is set off by a strip of colored material. Another two-color pull is made of round stock and a strip. The 90-deg. rabbet is best cut on a shaper or circular saw, and should be polished. An interesting effect of light and dark is produced by the black strip.



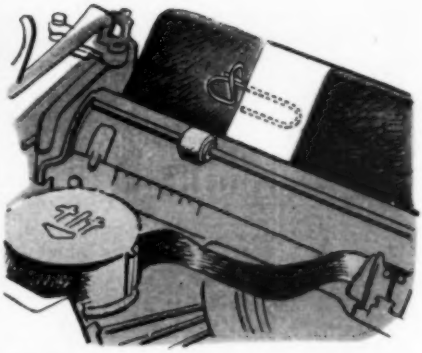
Forming this simple handle is an easy bending job. Bolts hold it together and to the drawer.

Clear rod, rabbeted to 90 deg. and mounted over strip of dark plastic, forms this drawer pull.

Wooden jig is shown at left; finished handle in center. Cut stock to shape shown at right.

Keeping the Home Shipshape

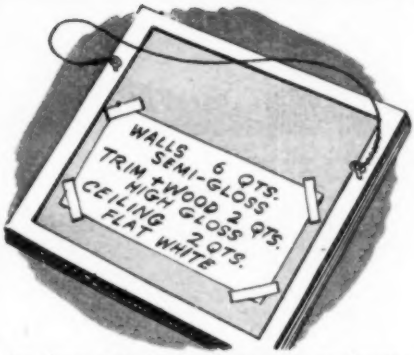
Tin cans won't pile up in the kitchen rubbish container with this disposal system. Cut a 6" hole in a cupboard floor and use a stovepipe to lead the cans to a cellar basket.



Typewriters that don't have lateral paper guides can be adapted for uniform paper setting by bending a wire clip as shown. Fasten the clip to the paper table with masking tape.

Luminous paint on door edges may prevent painful bumps, especially if anyone in the family leaves doors open at night. Apply bands of the paint to each door at about eye level.

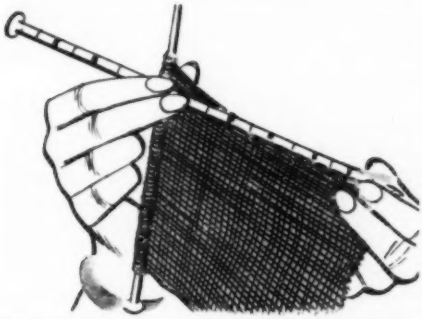
Large-denomination bills are less likely to be pulled out of a wallet and used by mistake if they are dog-eared at the corner to distinguish them by touch from smaller bills.



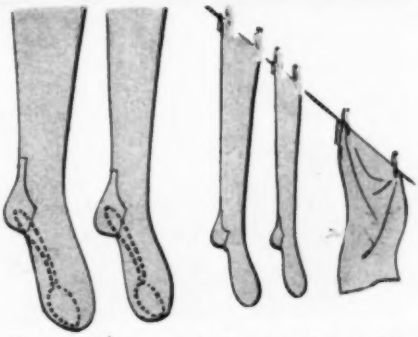
Jot down painting, wallpapering, or cleaning information on the back of a picture. Records of dates and quantities will help in planning purchases the next time you redecorate.

Short-stemmed flowers that defy graceful arrangement in vases can be lengthened by sticking the stems in drinking straws. Clear straws won't be seen in transparent vases.

Different kinds of baby food can be heated at one time in a three-cup egg poacher. When the food has been warmed, lift it from the tray and feed the baby directly from the cup.



Marking knitting needles in inches and fractions allows the knitter to work to the desired depth without bothering with a tape or rule. Scribe the lines or use fingernail polish.



Drop a teaspoon into the foot of a stocking when you hang it out to dry. The spoon will keep sheer hose from whipping around the line, reducing the danger of runs or snags.

Square eggs save space in the freezer. You can improve on the hen's packaging by breaking eggs into ice-cube trays and deep-freezing them. When solid, wrap each one in waxed paper.

Car Valves Hammer Craftwork into Shape

PROFESSIONALS use broad-faced hammers with thin, springy handles for metal chasing. The work is done with a rapid-fire tapping that drives the chasing tool both along and into the metal. An ordinary light hammer won't do; the small face makes it too hard to hit the tool cleanly, and its rigid handle won't permit the fast stroke needed.

You can make these three chasing hammers from old engine valves. They're mounted on steel rods having wooden handles, and have proved quite satisfactory.

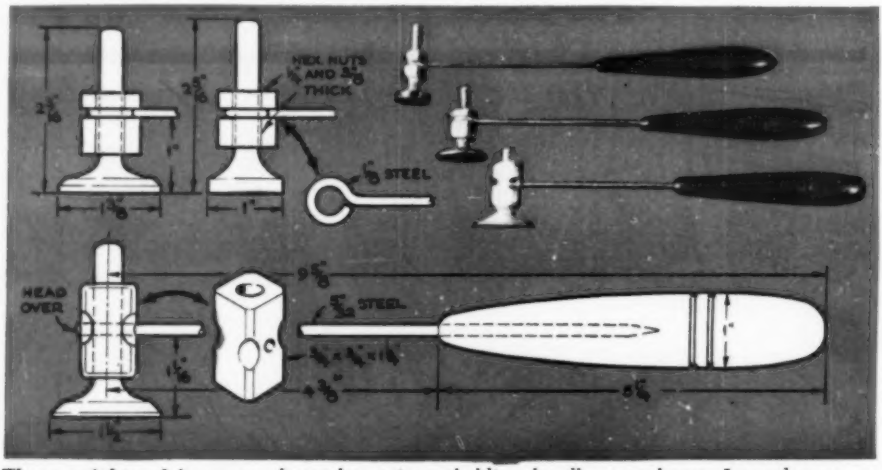
Hammer is held lightly, the handle pivoting in fingers. Hold chasing tool at 5-deg. angle.

Old valves can be had for the asking at many garages. If they have holes or slots in the head, fill these by welding or by silver-soldering in steel plugs. The head can be turned to diameter in a lathe with a tungsten-carbide bit or a tool-post grinder, or ground down on a valve refacing machine. The stem is simply cut to length and rounded off.

To secure the handle shafts, you can turn and bore a sleeve of mild steel to fit over the stem of the valve, drilling through this block and the valve stem for the handle. Peen over the end of the latter and flow soft solder all around.

You can instead heat the handle red hot and bend it around the valve stem into a loop, as shown for the two smaller hammers. Ream out two hex nuts to a snug fit on the valve, file everything bright, and weld, silver-solder, or sweat together with soft solder.

File the handle shaft on four sides to a square tapering point and drive it into an undersized hole in the wooden handle, which should be turned from maple, beech, or oak.—*Edward J. Thatcher, Woodstock, N. Y.*



Three weights of hammers do work ranging from jewelry to candle sconces. Two ways of holding handles are shown. Looped ones are locked between two nuts on stem of the valve.

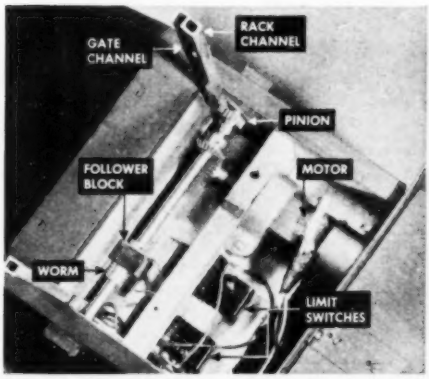
Electric Gate Lets the Cat Out

Did you put the cat out? The answer is no. She simply marches up to this gadget and lets herself out.

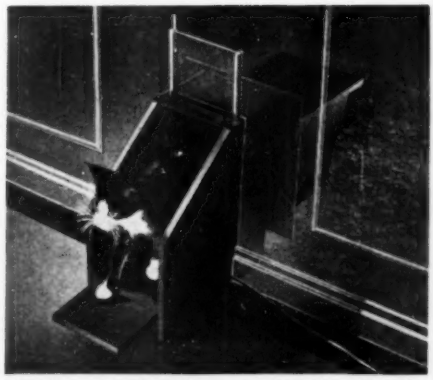
WHAT seems like one of the world's longer cats in the photo above is actually the beginning and end of two standard models. They are inspecting an electric cat-actuated door built by W. Griffin Paige, New York mechanical engineer. His product artfully compensates for cat behavior at doors, which is notoriously indecisive.

When a cat wants in or out, she simply marches up to the door. Her weight trips a sensitive switch (there's one under each ramp) and the door promptly rises. As long as she hesitates on either ramp the door stays open. When she steps off, a time-delay device takes over and shuts the door five seconds later. This gives protection if a hostile dog is loitering around the corner. If any malfunctioning should happen to close the door with a cat in transit, she still wouldn't be hurt. The light door fits loosely in a lifting frame and would just rest gently on her.

Teaching cats to use the gate was done in easy stages. At first it was installed with the door removed and the current off. After the cats had grown accustomed to it, the current was turned on. Then when they had become familiar with the motor sound, the door was put in.



Elevating mechanism consists of a rack and pinion. Pinion shaft also carries worm on which a block slides to actuate limit switches that stop motor at each end of gate travel.



Out for a stroll and no one the wiser. Weight of cat closes switch that starts motor, raising the clear-plastic door panel. Door remains open as long as cat is on either ramp.

Nine bass bugs made by the author and guaranteed to lure even the most reluctant bass into striking. Requiring only simple materials and tools, these bugs cost about a cent apiece.

1. Start with a cork about 1" long and ⅞" in diameter. Shave a ¼" slice off one side to form the bottom. With careful strokes of the blade, shave the rear end down to a point.

4. Work on the hook while the polish is drying. Lay a pinch of bucktail along the shank of a No. 2 hook. Bind it evenly and tightly with several wrappings of strong thread.

Homemade Bugs Pull in the Bass

SUMMERTIME is fishing time, and any angler can double the thrill of slipping a net under a fighting bass if he's using a bug he made himself. What's more, the bugs you can whip up for about a cent each would probably cost 50 cents at most tackle shops.

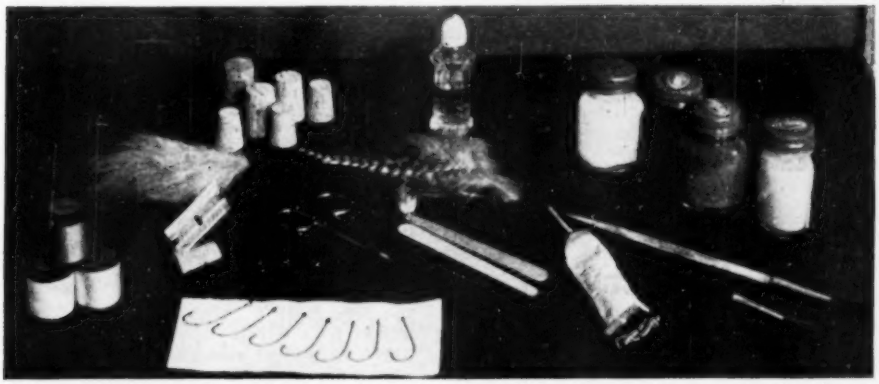
Most of the supplies you'll need can be found right around the house: thread, razor blade, scissors, corks, clear fingernail polish, and a few emery boards. You'll also need hooks, several small bottles of model-plane dope, cement, and a small paint brush. Feathers and bucktail for wings and streamers may have to be bought at a tackle store. Start with a simple bug and, as your skill increases, you can begin to add wings and experiment with fancy new shapes.—*Thomas William Helm III, Birmingham, Ala.*

2. After the rough shape of the bug has been cut out, work with an emery board. The smoother you get the cork, the better it will take the coats of paint and polish that follow.

3. Using a knife as a handle for the cork, give the bug a heavy coat of clear fingernail polish. Work the lacquer well down into the tiny pores and grains in the cork.

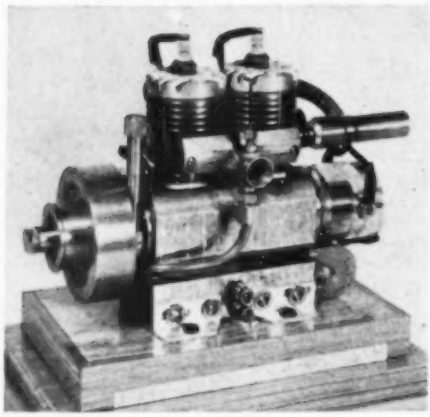
5. Cut a slot ⅛" deep and ⅛" wide in the flat side of the cork. Fill the slot with waterproof cement and place the shank of the hook in it. Be sure the cement is waterproof.

6. Before painting, rub down any rough spots in the polish with an emery board. Then give the bug two or three coats of fast-drying paint or dope. Let it dry thoroughly between coats.

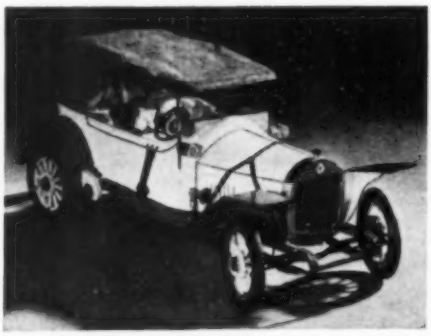


Here are all the supplies and tools you'll need to whip up a batch of your own bass bugs. Many of these items—scissors, corks, thread, and razor blades—can be found around your home.

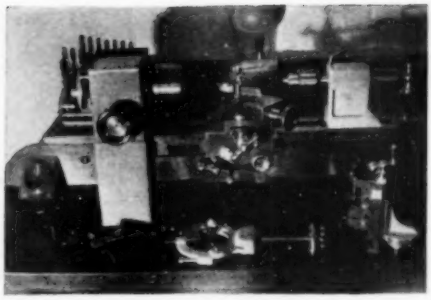
CRAFTSMEN AT WORK

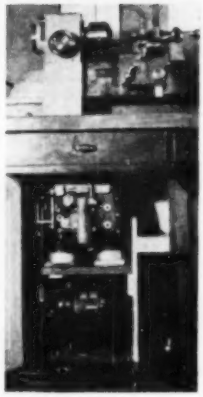


Alternate-Firing Twin. Developing an estimated 1 hp. at 7,500 r.p.m., this air-cooled two-cycle engine is only about 6½" long and 4½" high. It was built by Alton Dorfmeier, of Fresno, Calif. With the exception of a pair of rough castings for the pistons, he used nothing but scrap metal in constructing the basic engine. It has a counterbalanced crankshaft turned from one piece. Two power impulses per revolution deliver an unusually smooth power flow, its builder says, and it starts at the first pull of a cord wrapped around the flywheel hub. Total parts cost was about $13.



Isotta Fraschini Modeled. Scaled at ¾" to 1', this finely detailed mantel model of a 1914 Italian car was built by PS contributor Herbert Lozier, of Brooklyn, N. Y. The chassis is shim brass, the body cardboard, and the upholstery real leather.





Precision Job. Norman EnHolm, a mechanical engineer of Lake Mahopac, N. Y., devoted three years' spare time to building this bench lathe. The distance between centers is 13" and the swing is 6⅝". EnHolm reports that the parallelism between spindle and bed is within .0003" in 13". The bed was built of two pieces of steel, heat-treated, aged, machined, rough-ground, assembled, and precision-ground to a mirror finish. The spindle, machined from tool steel, runs in large, taper roller bearings, driven by spiral gears from a jackshaft. The compound rest can be replaced with a milling attachment. A hydraulic transmission, controlled by a dial at the left of the bench, gives spindle speeds from zero to 1,100 r.p.m. in either direction. This was originally a gun-turret control mechanism.

Plastic Press. Standing less than 10" high, this working model of a drill press is made almost entirely of black Lucite®. It took John Dumas, Manhattan, N. Y., more than 200 hours to build it. Six splines on the spindle are milled to a depth of .037". A midget electric motor operates it through step pulleys.

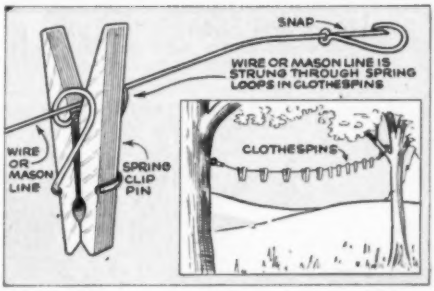
Silhouette Makes Night Light

In a child's room or hallway this silhouette-shaded night light is both unusual and useful. It's a low-cost, kitchen-table project, since it is made with cardboard and glue.

Laminate two or three sheets of heavy cardboard or showcard stock with glue. Cover one side with black paper and the other with gray paper; the latter is to serve as the back of the lamp. Trace the outline of the design you select on it. Cut it out with a sharp knife or a coping saw.

Build up the oval base of laminated cardboard. Cover the edges with a strip of black paper, or brush on India ink. Glue the silhouette to the base and fit thick cardboard braces at the back. Apply generous dabs of the glue for strength. Use a 7½-watt frosted bulb and a candelabra-size Christmas-tree socket. Mount the socket in one of the braces, as shown in the photo at right. With this mounting in a regulation socket there is no danger of fire, since the bulb generates very little heat. To be most effective, the lamp should be placed at, or a little above, eye level and about 1′ from a wall.

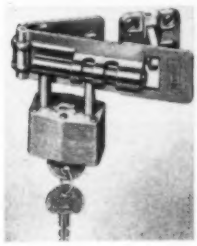
Camp Clothesline Snaps On



Aerial wire, snap links, and screw eyes form a camper's clothesline that's easy to put up and take down. String the wire through clip-type clothespins and wire the links to each end. Twist the screw eyes into a couple of handy trees and the line is ready to use. If the trees or limbs are located right, you may not need the screw eyes. Simply loop the wire around a limb and snap the link on the wire.—*John Krill, Youngstown, O.*

Lock Combined with Hasp

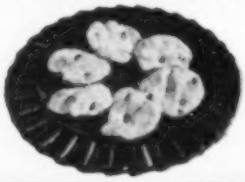
A laminated padlock, safety hasp, and sliding bolt all are combined in this unit manufactured by the Master Lock Company, of Milwaukee, Wis. Attached permanently to the bolt, the padlock swings freely to permit use of the unit on either right or left doors. Other features include a pinless hinge for extra security and reinforced and recessed screwhead seatings. The lock is priced at $1.25.



Rack Holds Drawing Pens

All your drawing pens are always visible for quick selection and use in this rack. The base is ¾″ by 2½″ by 10″. Use a circular saw to cut three 3/16″ by ⅜″ grooves at a 20-deg. angle. I glued strips of corrugated cardboard in the grooves to hold the pens upright.—*Glenn A. Wagner, Delmar, N. Y.*

Turned Tray Has Ruffled Rim



A tacked-on strip guides the work along the fence. Align the cutter with center of disk.

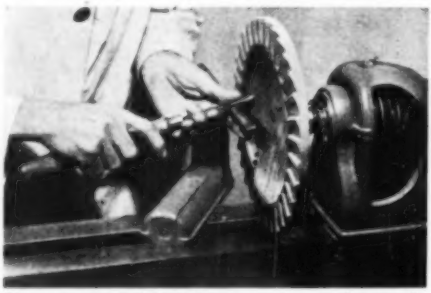
RADIAL molding, which gives a ruffled rim, puts this tray in the "one of a kind" class. The ruffles are shaped on a circular saw with a homemade cutter.

Mount a 1" by 12" turning blank (I used walnut) on the lathe faceplate, face true, and turn the edge true. Glue a piece of waste to this face, and remount with the faceplate screws in the waste. True the other face; then unscrew the faceplate from the spindle to form the ruffled edge.

For this you can make a cutter from a piece of ¼" carbon steel. Twist one end 90 deg. (you may have to heat it) and drill a hole to fit your saw arbor in the long shank. File the profile at a bevel to form a cutting edge, heat red hot, quench, and temper.

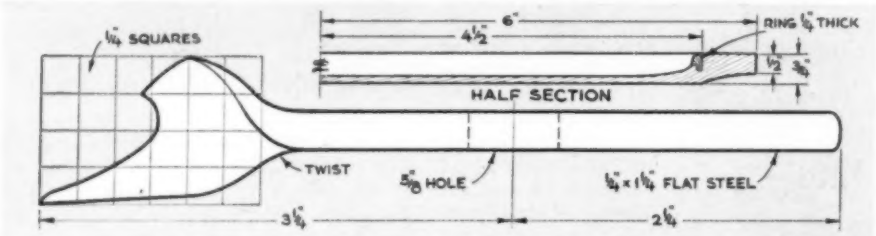
Tilt your saw arbor or table to 45 deg. and try the cutter on waste to determine the width of the ruffle it forms. Mark the disk edge accordingly into uniform spaces. Tack on a guide strip with a witness mark and align with the edge marks for each pass.

Remount on the lathe and turn out the inside. I turned a groove and fitted a ring into it, but you can instead turn a simple cove. Sand and part from the waste. Sand the ruffles by hand or with a brush-backed rotary sander. Finish with shellac, varnish, or wax.—*Benjamin Nielsen, Aurora, Neb.*

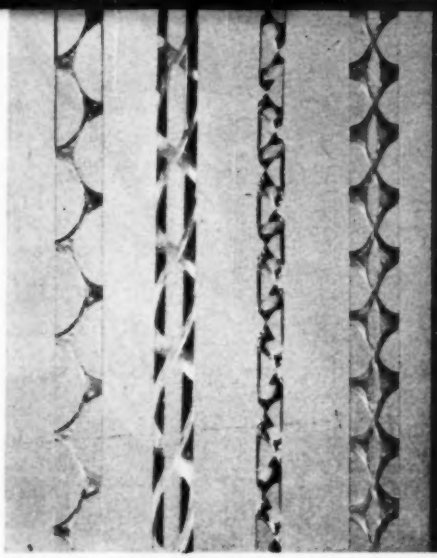


Remount on the lathe to turn out the inside after ruffles are formed. Sand the turned part.

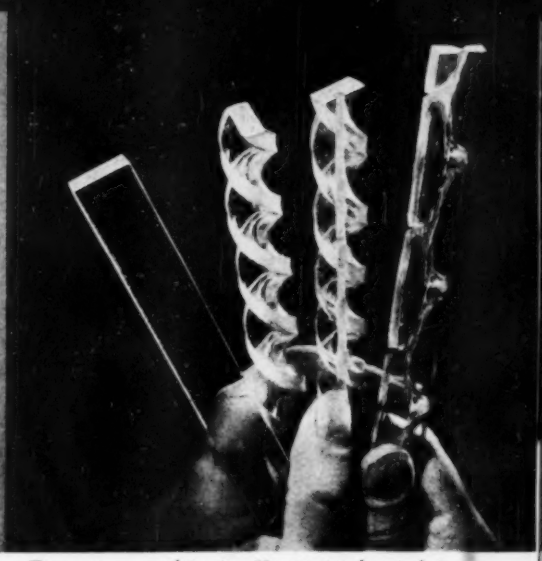
Ring is glued into groove. It can be omitted if you prefer to turn a plain cove up to the rim.



Draw cutter profile on paper, following the squares. Glue to steel and file to a sharp edge.



Pattern is inside strips at right and left above, a puzzler to present to your craft-wise friends.



Four steps explain it. Heat-twisted spiral is grooved. On reheating, kerf becomes pattern.

Plastic Memory Creates New Craft Forms

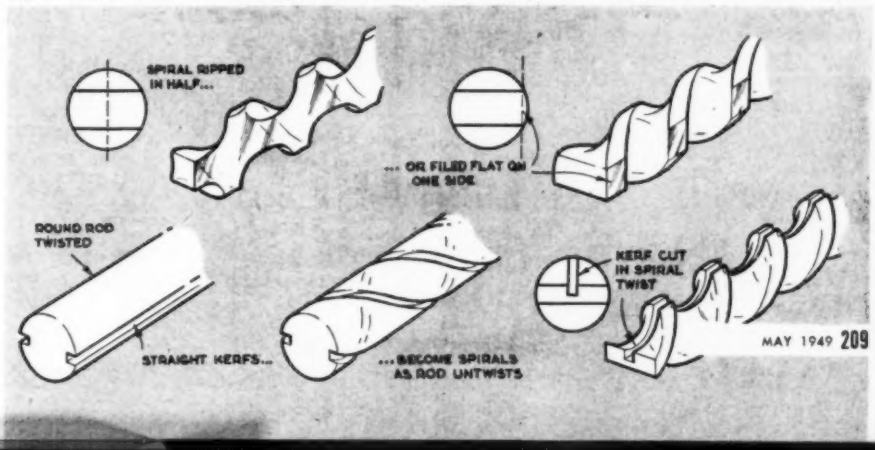
TO LOOK at them, you'd think these ornamental strips would be hours in the making. Two of them have an internal pattern, and few craftsmen can guess how it got there.

The secret is in plastic memory. Acrylics like Plexiglas® and Lucite®, if shaped while hot, return to their original form when reheated. Cut a strip (at left in right-hand photo), heat it until limp, clamp one end fast, and twist to an even spiral. Then run a saw kerf lengthwise, down to the bottom of the twist. Toss the spiral back in the oven, and it'll resolve itself into a flat strip with a zigzag inside cut.

Two kerfs give you a double zigzag. Cut the spiral in half lengthwise, and you get two deeply notched pieces. The narrow strip at left above was made by spiraling and cutting in half a strip ⅜″ square. Another variation is to file or sand off a lengthwise section. Kerfs or cut surfaces can be polished or left frosted, the final effect varying accordingly.

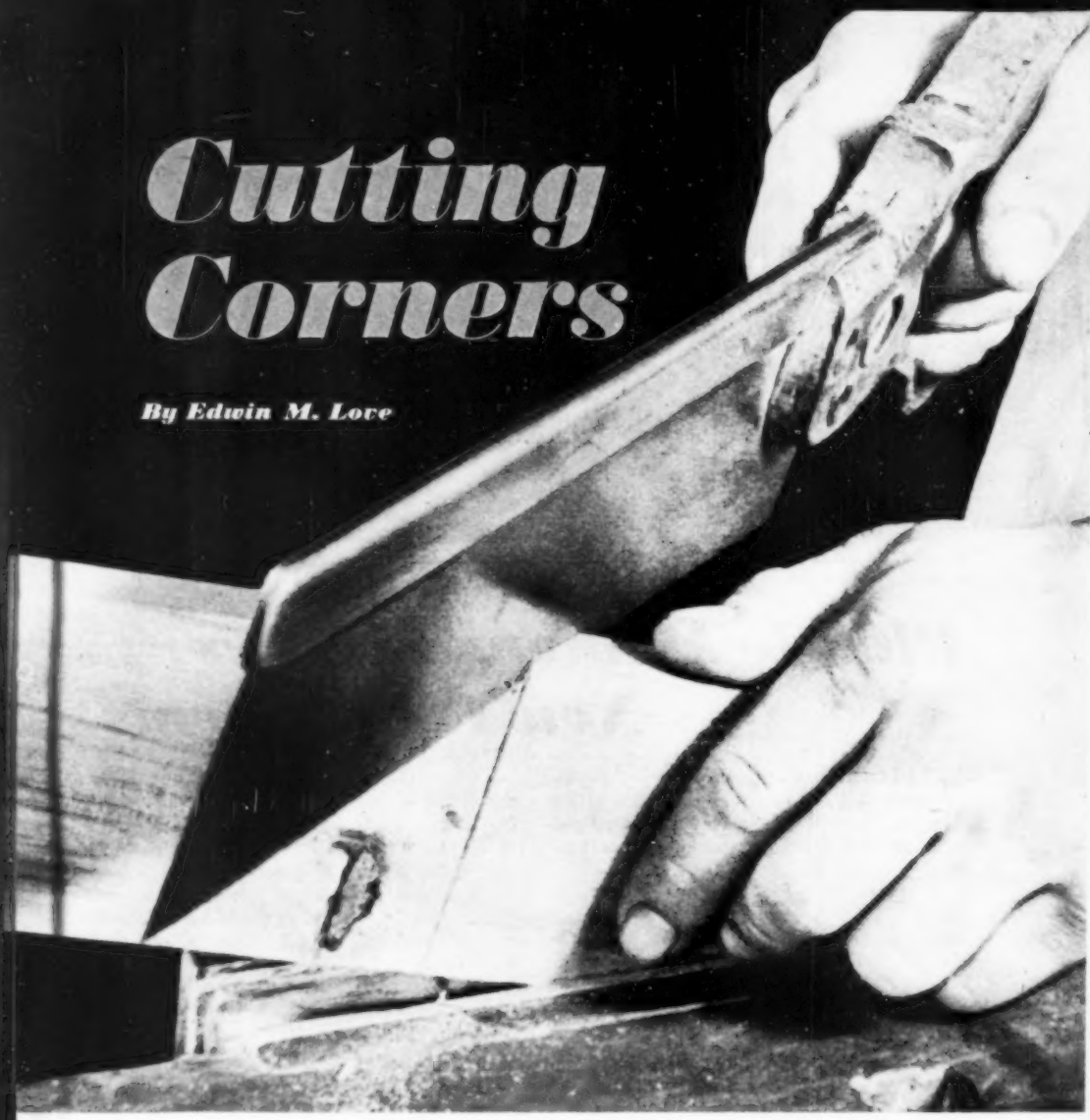
Round stock remains round when moderately twisted, but straight-cut kerfs turn into spiral grooves when it's reheated. This makes good lamp standards; the lamp cord, split into two wires, can run up the grooves. —*M. J. Moch, Jamaica, N. Y.*

Try variations on these examples by using strips of square or other cross section instead.

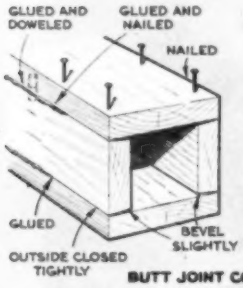


Cutting Corners

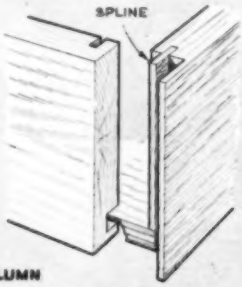
By Edwin M. Love



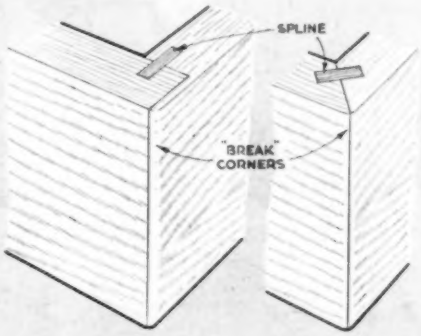
1. On painted or utility work, butt joints usually provide ample strength for column or box corners. Nails, glue, or dowels can be used, depending on the stress the joint has to bear. With fine work, avoid breaks in the grain by using mitered or rabbeted corners.



BUTT JOINT COLUMN



SPLINED RABBET JOINT



Butt joints are the easiest to make by hand, but rabbets and miters have a lot else to recommend them.

BOX sides would be easy to cut and fit if boxes had only three joints. It's the fourth that causes all the trouble. There's no wood to spare for a second try at that last joint. It fits—or else. The fit is particularly critical in a mitered corner. A slight error in the angle of an ornamental bevel may go unnoticed, but nothing less than accuracy will make a strong and tight miter joint.

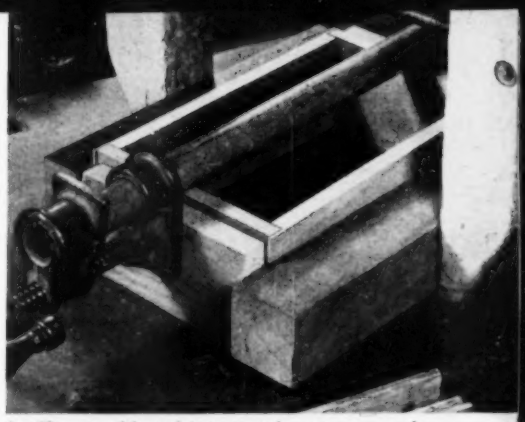
Gluing the parts together is a teaser, too —especially with slippery miters that won't stay put. But while making boxes has its problems, they can usually be licked by proper methods. Doing the job the right way usually means getting it done right.

Butt joints are fairly satisfactory for work that's to be painted or varnished. You can just glue the square ends of one pair of sides to the other pair, or nail the pieces together, using any of the tricks suggested in the left-hand drawing of Fig. 1. Beveling edges slightly inward gives a tight fit at the exposed meeting line. Dowels and glue add strength to a joint and are desirable when the corner has to bear any strain.

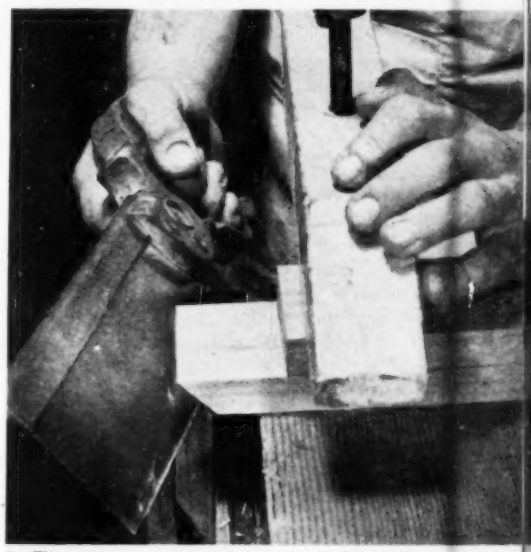
For fine work in beautiful wood you'll want the grain to run continuously around the box either horizontally or vertically. Continuous grain is a must when using plywood with a face veneer, for the ply edges should be hidden. Mitering is just one method of making the corners meet. Rabbeted joints such as shown in Fig. 1 are also first rate. Cut the rabbet to within 1/16" of the face—or to the face veneer when using plywood—and take pains not to split the thin flanges. Aside from the precautions that are necessary because of the thin face layer, these rabbets are made in the usual way.

It usually makes little difference if the size of a rectangular box is off a small fraction of an inch. What does matter is that the opposite sides must have identical dimensions. The price of neglecting this is a cockeyed assembly.

Rabbeted construction gives lots of glue area, but the joints may turn out poorly if the end grain sucks in the glue and leaves the meeting surfaces dry. You can prevent this by sizing end grain with thin glue. Allow the sizing to dry while the clamps are being adjusted. If there's any residue, scrape

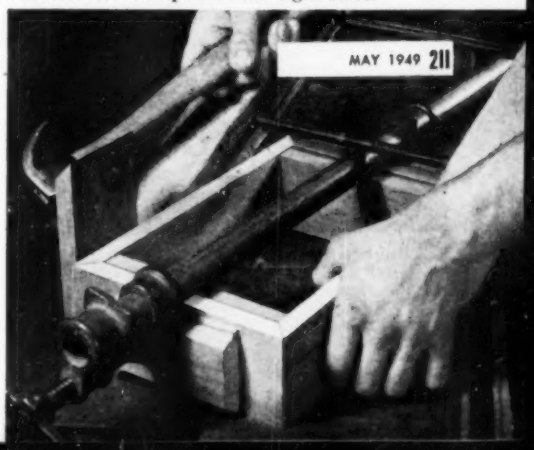


2. Clamp rabbeted joints with protective pads that extend beyond the corners. Wipe off excess glue. Later, trim off any projecting stock.



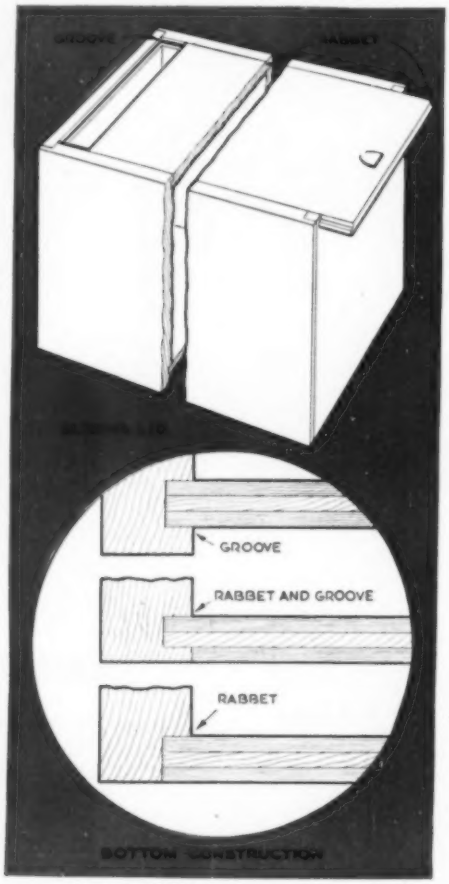
3. To correct a poor miter cut, clamp the pieces at right angles with the meeting ends close together. Saw between the miters.

4. Slippery miters can't escape this gluing jig. Sides are first clamped to spacer blocks. Then the ends are clamped to the rigid sides.



5. When nailing miter corners, project one piece over the other. Driving the nails will pull the two pieces together at the edge.

6. Dowel holes should be located toward the back of a mitered end. Clamp the wood in a vise with the miter level at the top.



7. Rabbeted lids sliding in grooves are often used for box tops. Box bottoms are usually one of the three types shown immediately above.

it off before applying the glue for the final assembly.

One method of clamping the box parts is pictured in Fig. 2. The protective side pads must be stiff and long enough to project over the corners, where they can both apply pressure and protect the flanges. End pads should reach nearly to the corners. Be sure the assembly is square, and wipe off squeezed-out glue with a damp rag. When the glue is dry, dress any projecting flanges flush with the ends, "breaking" the corners by rounding them slightly.

A slip-tongue or spline reinforcement is pictured in Fig. 1. In thin stock a heavy saw kerf is wide enough to receive the spline —which is simply a strip of hardwood that has the grain running across the width. Splines increase the strength of a mitered joint and make it easier to assemble the sides and ends. Hardwood 1/16″ thick is all right for light work; in thick stock use pieces up to ¼″. If you're working with hand tools, the larger grooves can be made with a combination plane, or you can make two parallel saw cuts and chisel out the waste between them. In chiseling, work from both ends toward the center.

To lay out a miter joint, square a line across one face, draw an angle on each edge connecting with it, and complete it in a line across the other face. The point of a knife is good for marking. Sawing a miter is pictured on page 210. Watch both face lines. If the saw strays from either, twist it back or begin cutting from the other edge. Smooth any roughness with a block plane.

Despite care in sawing, you may end up with a faulty joint. One way to remedy a poor cut is shown in Fig. 3. Clamp one piece in the vise and the other—just touching it—to the bench top. A block may be needed under the horizontal piece to bring it into position. Saw between the miters. If the first cut doesn't make a fit, try a second one. Be sure the pieces are clamped at right angles to each other, and don't forget that the sides will be slightly shortened. Apply sizing to the miters before final gluing.

There's an excellent dodge for clamping miters shown in Fig. 4. The two long sides are clamped to a pair of blocks cut to the exact inside length of the ends. Held tightly in this fashion, they can't slip or move when the mating end pieces are clamped to them. Tap the joints into alignment.

Utility work only requires nailing. Figure 5 shows how this is done. Note that the

8. A plane gauge, made from three pieces of wood, is extremely valuable in correcting miters for columns using five or more staves.

9. Column clamps help to assemble the pieces. Rope or baling wire will also do the job but they require greater care in handling.

piece being nailed projects a little beyond the other. The pressure of driving home the nails brings them together at the corner. Lock the joint by driving a couple from the other piece.

A heavy joint is usually improved by doweling. Locate center holes well toward the back where there is more stock. Clamp the piece in a vise with the miter level, and it will be simple to square the holes with it. A bit gauge (Fig. 6) is also a big help. Set it just short of letting the bit point prick through the board, or use a twist drill.

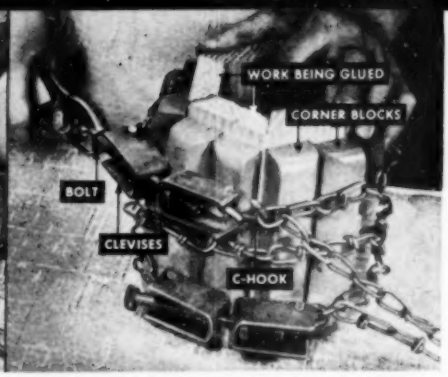
Most box bottoms in light work are fitted into rabbets made in the sides before the pieces are assembled. They can be entered after the sides are glued, and, being out of sight, are often nailed. Greater strength can be obtained without sacrificing inside depth by using the rabbet-and-groove construction shown in Fig. 7. The same construction is suitable for flush sliding lids. It's simpler to enclose the plain edges of the bottom in grooves, but some inside depth will be lost.

Columns are a kind of extension of box making. The rabbeted corner is convenient for a four-sided post, but mitering is the best solution for a handmade column of five or more sides. No matter how accurately you work, you're almost certain to find one or more faulty joints when you assemble the column without glue to check the fit. A plane gauge is practically indispensable for correcting the miters. Figure 8 shows such a gauge in use. It consists of a strip of wood with a wedge-shaped piece nailed along the top of one face. The strip is clamped to the cheek of a jointer plane. As the plane iron doesn't extend the full width of the plane, a lining strip ¼" thick is tacked to the inner face of the gauge. Make a test cut on scrap. If the angle is badly off you'll need a different wedge-shaped piece, but small corrections can be made with by shifting the plane-iron position with the lateral adjustment lever. The iron must be sharpened to a straight edge.

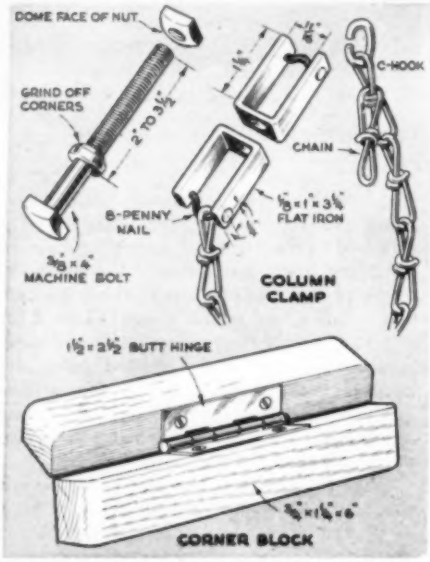
Proper handling simplifies the usually troublesome job of assembling a column. Paint the glue rapidly on the edges and stand the pieces on end for assembly. This allows the tackiness of the glue to help hold them together. Have ready a piece of light rope with which to bind the column at the center. Nothing is better than column clamps for assembling, but they are rather special tools and other means are often used. One satisfactory method is to wind rope tightly around the work from one end to the other. Drive wooden wedges under the coils to tighten them up. Baling wire coiled around the column and wedged has the advantage of not stretching like rope. If some staves work out of line, use clamps to force them back and tap the joints into alignment. Assembly is easier, of course, if you spline the work.

Figure 9 shows a homemade column clamp in use. Construction of the clamp is detailed on the following page. END

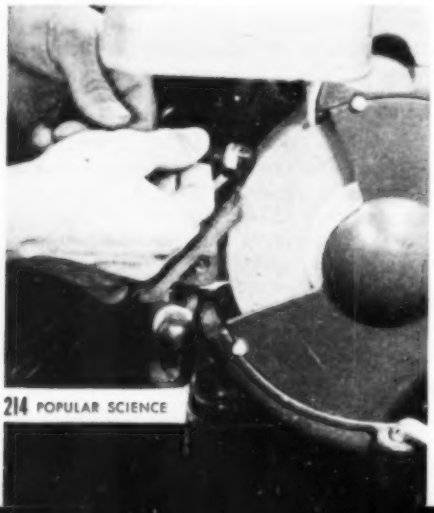
Attach the selected chain link to the clamp clevis with a C-hook bent from heavy wire or a spike. Two sets of clamps are shown above.



Tighten up the clamp bolt with pliers. Domed nuts working in oversize holes permit the clamp halves to be tightened at an angle.



Dome the nuts by grinding. Tighten two against each other on a bolt (below). Interchange the nuts to grind the second one.



Chain Clamps Do Hard Gluing Jobs

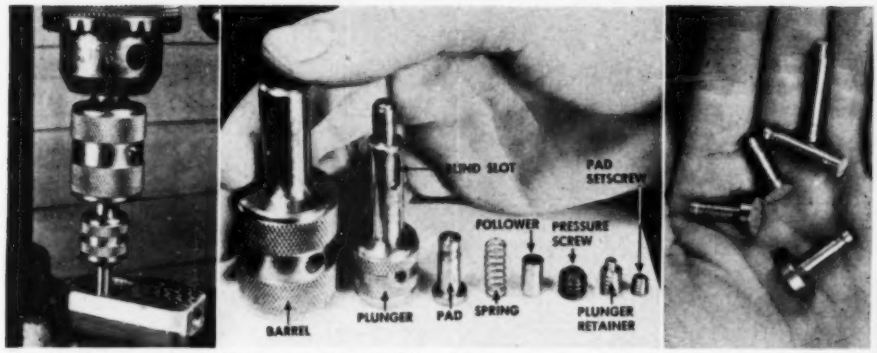
COILS of rope or twisted wire are substitutes—but only substitutes—for column clamps. In gluing up the staves of a post or built-up bowl, special clamps usually pay off both in time saved and improved work. For putting columns together, it will be worth your while to make one or more sets of these efficient chain clamps.

Two pieces of strap iron are bent into U's as shown at the left. The closed ends are drilled 9/16" and countersunk inside. Slip an 8d. nail through an end link of a 3' to 10' length of light chain, bend the nail into a shallow loop and pass it through holes in the arms of the U. The loop in the mating U receives the C-hook that is linked to the chain.

If the threaded portion of the bolt is too short, lengthen it by running down a ⅜" die. Grinding a dome on each nut gives a ball-and-socket action to the clamp. One nut of each pair is screwed down to the base of the bolt threads. Insert a bolt in a pair of U's and slip on the second nut.

Hinged corner blocks prevent marring of the work by the clamps. They adapt themselves to any angle and can be made in short order from scraps of hardwood. Round the corners so the chain will fit smoothly.

Before applying glue to the joints, adjust the chain length and insert the C-hook in the right link. When the glue is applied, set the corner blocks and slip the clamp or clamps around the assembled parts. Take up slack by turning the bolt finger tight, tap the joints into alignment, and cinch up on the clamp bolts with pliers or a wrench.—*Edwin M. Love, Palmdale, Calif.*



Put the last touch on those pet projects with spot finishing. This spring-loaded pad does a good job. Use a graduated fence to insure uniform spot spacing. Center above, the disassembled tool. An assortment of pads to hold abrasive disks meets a variety of needs.

Spring Pads Do Fine Spot Polishing

SPOT polishing, that de luxe method of finishing fine metalwork, becomes easier to do and more uniform in result with this spring-loaded tool. The cushioned plunger prevents excessive pressure on the abrasive, which lasts longer because the grains aren't crushed, and work is less likely to creep under it. Pressure is adjustable.

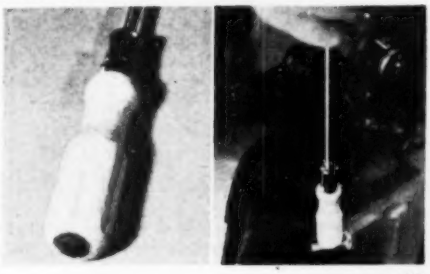
All the parts can be cold-rolled steel. The various bores and shanks must be concentric. One way to insure this is to start with the plunger. Turn the shank, and do the knurling, between centers. Then lay this aside and chuck stock for the barrel, knurling close to the chuck and then turning down the shank. Mount the latter in a collet or milling-cutter arbor to drill the two holes inside the barrel. Then you can insert the plunger, with the ¼″-20 setscrew to drive it, and drill the ¼″ hole for the pad. The slot should let the plunger move freely, but not loosely, about ¼″.

Several pads, with faces from ⅛″ to ⅜″ in diameter, should be made for the abrasive disks. Hold these on with cement.—*John A. Bates, Wise, Va.*

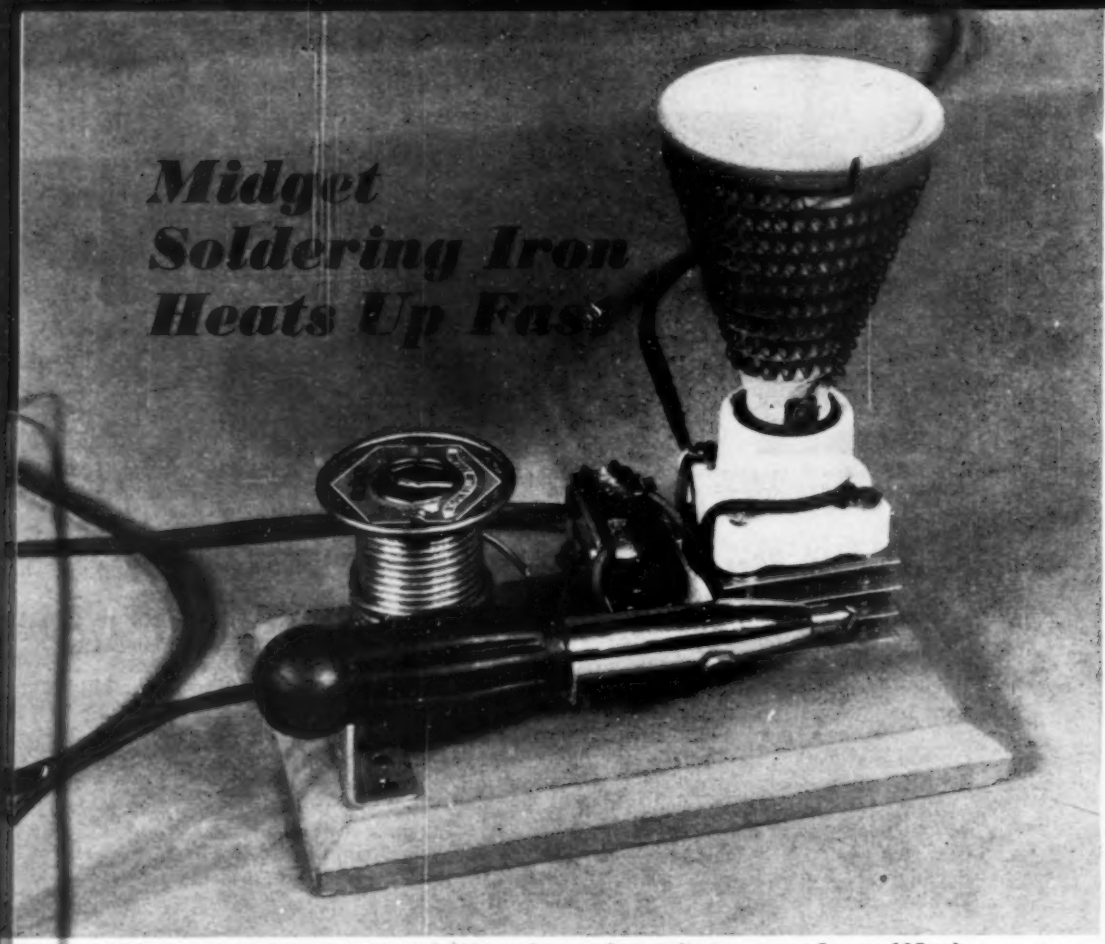
Mill a blind slot in the plunger or, if you have no milling attachment, simply file a flat.

Magnet in Screwdriver Retrieves Small Parts

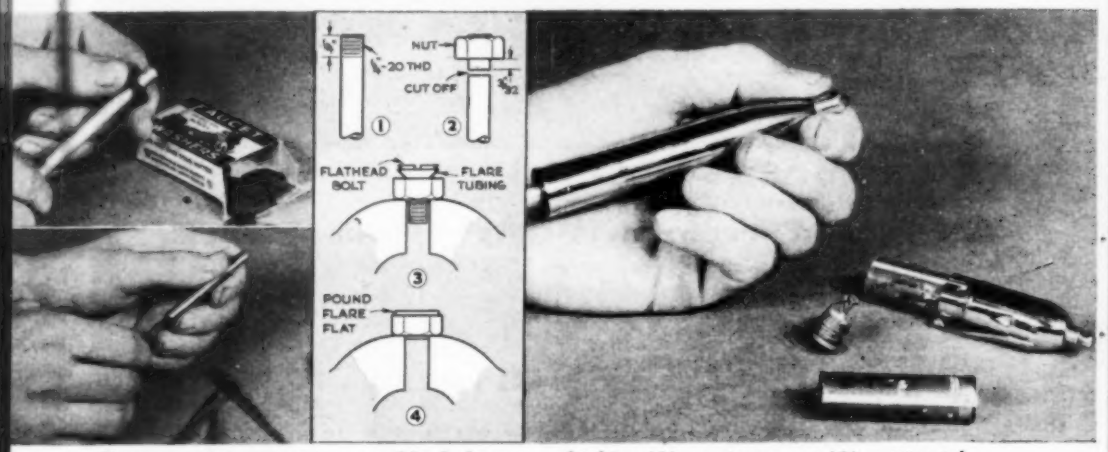
THE magnet in the handle of this screwdriver picks up bolts, screws, and small parts that are dropped in inaccessible places. I used a magnet about 5/16″ by 1½″ that I bought at a hobby shop. You can either force or cement it into a hole drilled in the handle. It should protrude slightly beyond the hand end and it should not touch the screwdriver blade. The ideal magnet would be an Alnico ®. They're permanent and support great loads.—*W. Thomas, Kenmore, N.Y.*



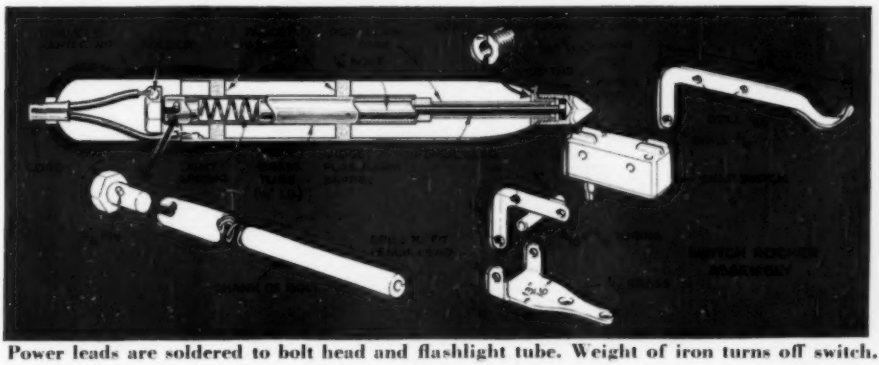
Midget Soldering Iron Heats Up Fast



Carbon in its tip does the trick. A 1,000-watt heater element limits current flow on 115 volts.



Faucet washers support a pencil-lead element assembly in the barrel of a midget flashlight. Collar for tip can be made by threading piece of tubing (1), turning on nut (2), cutting tubing, flaring the cut end (3), flattening (4), sawing screwdriver slot, and removing nut.

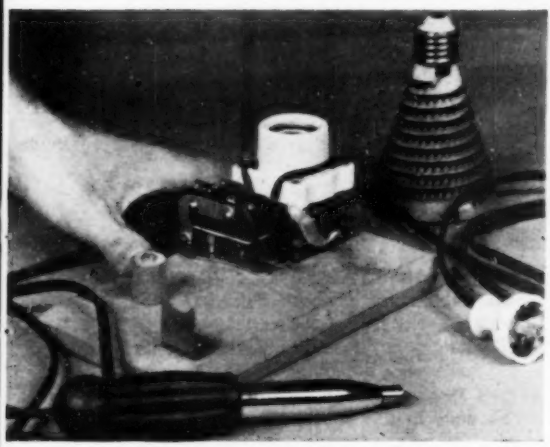


Power leads are soldered to bolt head and flashlight tube. Weight of iron turns off switch.

LIFT this handy little soldering iron off its cradle, and it gets hot enough for use in a matter of seconds. Put it back, and the current automatically shuts off. Resistance provided by a 1,000-watt heater element, wired in series, fits the iron to 115-volt current. Without the resistance, it will operate from your car battery.

A carbon element is the secret of its speedy heating. An ordinary pencil lead rests against a carbon disk inside the tip. When sufficient current is passed through, the junction of the carbon and the graphite becomes white hot practically at once.

A chromium-plated midget flashlight tube makes an attractive body for the iron. A tricycle grip serves as a handle. The element assembly consists of a ¼″ machine bolt, brass tubing that slips freely over the bolt, a light compression spring, a pencil lead about 1½″ long, a disk cut from a 3/16″ dry-cell carbon, and a small porcelain tube.



Cooling fins elevate the porcelain socket of resistance element. Note that wood base also has a post to retain a spool of wire solder.

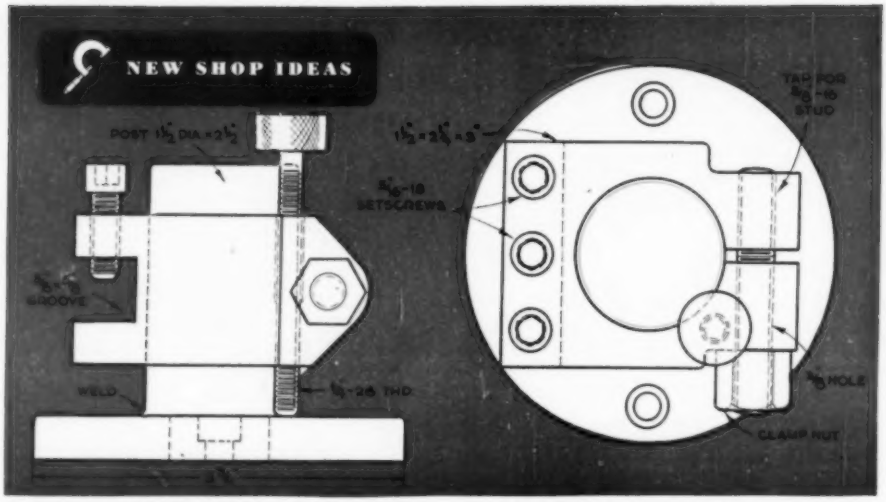
Cut through the bolt about ½″ from the head. Drill a transverse hole in the part of the shank that remains with the head and press in a 1/16″ pin. Cut an L-shaped slot in one end of the brass tubing so the pin will lock the bolt head in the tubing. Drill one end of the long section of the bolt shank to accommodate a lead taken from a pencil. The lead in an "H" drawing pencil does a good job, but any other with about the same degree of hardness will serve.

A small porcelain tube insulates the pencil lead from the tip collar. You can get a suitable porcelain tube by removing the winding from a small radio resistor. The spring tension should be just enough to keep the lead firmly against the carbon disk. Faucet washers, drilled and filed to suit, center the assembly inside the flashlight casing.

If a lathe is available, you can turn a collar to retain the tip. If not, a collar is easily made from tubing as illustrated in the drawing on the facing page.

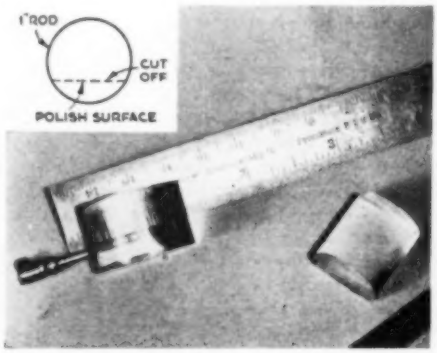
Use an existing tip if you have one on hand. Otherwise, you can make one from scratch or cut down a tip taken from a larger iron.

Automatic control of the iron is provided by mounting a normally-on midget snap switch on a brass rocker assembly. A transformer would be best to cut down the voltage. But if you haven't a suitable one, a 1,000-watt heater element mounted as shown and wired in series with the iron and switch will do the job.—*Don Pittwood, Moscow, Idaho.*

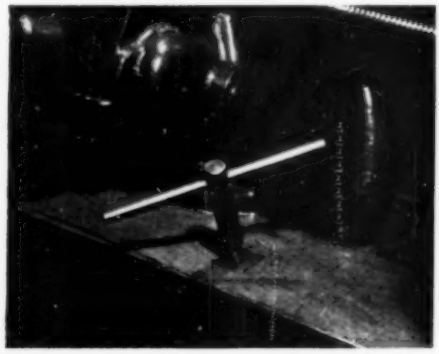


Toolpost Is Rigid. Quickly adjustable for tool height, this toolpost gives the utmost rigidity for boring, turning, and facing. The rake of the tool doesn't alter in height adjustments, as sometimes happens with slotted posts. This rigidity is especially important if you use carbide-tipped tools. The post can be swung in a full circle.

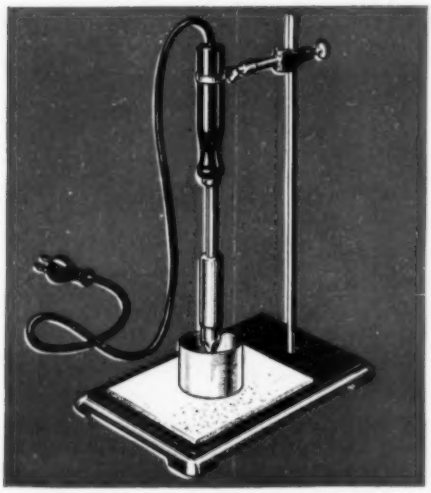
Use mild steel in making it. As the drawing suggests, the post can be turned with a tenon to fit a hole bored in the base disk, and the two members then welded together. However, if you have stock of sufficient size you could turn the base and post as one piece. Remove the compound rest and mount the post with two socket screws of suitable size countersunk in the base. The compound and regular toolpost can be quickly restored when needed.—*A. E. Kerswell, San Bernardino, Calif.*



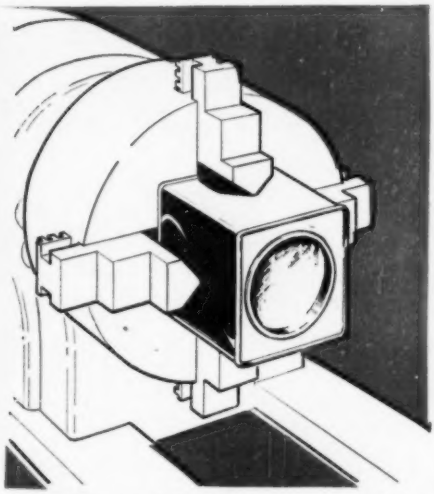
Shop Lenses Cut from Plastic. Starting with a 1" clear-plastic rod, you can make useful, practically unbreakable lenses for your shop. Pick an area of rod that's free of scratches and saw off a short length. Grind a flat as in the drawing and polish it. Placed with its axis across a ruler as above, the lens widens the divisions. Such a lens does a good job over the collar of a lathe feed screw.



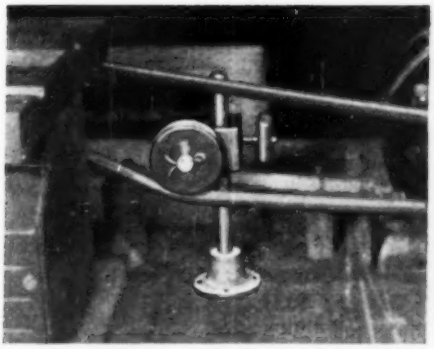
Keep Your Chuck Key Handy. If your lathe chuck key has a habit of hiding, here's one way you can keep track of it. Drill a hole at an angle through a ¼" plate and countersink the plate at a convenient spot in the bench. Or, if you prefer, just bore a hole in the bench top and omit the plate. The idea won't work, of course, unless you put the key back each time.—*Dwight Durkee, Jr., Cupertino, Calif.*



Melting Solder for Tinning. A soldering iron clamped to a laboratory stand is a good source of heat for melting solder and lead for dip tinning or casting of jewelry pieces. A double layer of sheet asbestos, or perhaps a brick, should be placed under the melting pot to prevent heat from being drawn off. Liquids can be heated in the same way. Be careful to have the iron tip tight.—*John Behall, Richmond Hill, N. Y.*

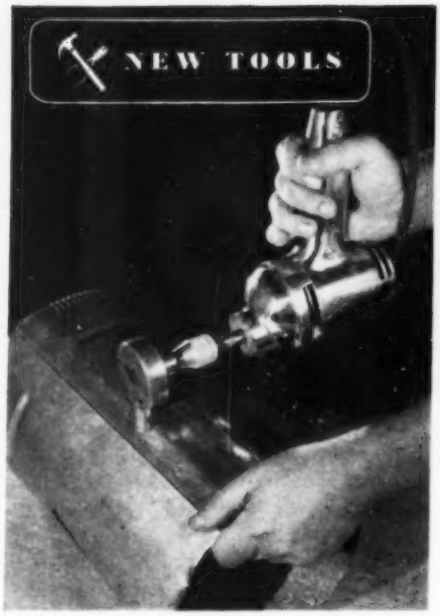


Polishing Small Parts. A tumbling box for polishing small metal parts can be improvised by chucking a tin can in your lathe. A square tobacco can is ideal for this, since it is easily held in a four-jaw chuck. Besides the parts that are to be polished, put some sand and a little kerosene in the can. Use a very slow spindle speed. Finish off with abrasive grains in place of the sand. —*George Morenus, Homer, N. Y.*



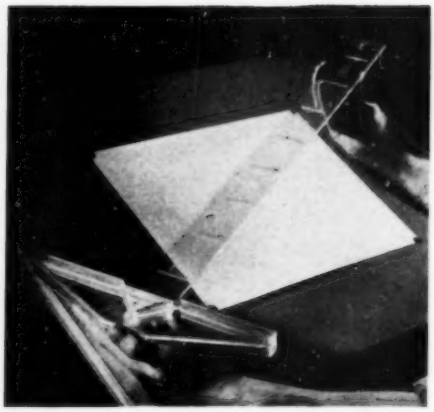
Idler Pulley Adjusts. An adjustable idler pulley can be made by drilling ½″ holes (not intersecting) at right angles to each other through adjacent faces of a 1″ by 1″ by 2″ steel block. In one, drive a piece of ½″ rod and mount a pulley on it. Through the other insert a loose-fitting rod vertically, installing a setscrew to hold it in position. Mount the vertical rod on a flange.—*Frank J. Keller, Philadelphia.*

Knife Cuts Sheet Metal. A stubby knife blade tapped with a hammer is a good emergency way of cutting circular openings or other holes in light sheet metal. Pencil the outline of the hole, drive the blade through the metal, and guide it along the line while tapping the blade with a hammer. The photo shows an old paring knife, with its blade shortened to 1¾″, being used to cut a hole in a furnace duct.



Cuts Sheet Metal. A sheet-metal cutting tool that attaches to any ¼" electric drill is now produced by the Nord International Corp., of New York. Called the Nibblex®, the attachment is said to be capable of making a circular cut with a radius as small as 1". It handles any sheet metal up to 20 gauge and is especially handy for a quick job on pipe, as seen above. It also cuts sheet plastic. The compact unit weighs 13 oz.

Impact Hammer for Drill. New attachments by which you can convert an electric drill into an impact hammer are now on the market. Above is the Hamer-Dril®, made by Hamer-Dril Company, New York. It chucks in a ¼" drill and comes with two tool holders that take a wide range of bit sizes. The price is about $22.50. Another attachment is offered by Crandall-York, Inc., Union City, Pa. It attaches to ⅜" or ½" drills, takes bits of the same size, and sells for about $10.



T-Square Molded of Plastic. The head and blade of this plastic T-square are molded as one piece. In comparison with T-squares that have the blade screwed to the head, the manufacturer claims that the integral construction guarantees complete accuracy even if the tool is subjected to rough treatment. The clear plastic gives full visibility of the surface on which the T-square is placed. A product of Instrumaster Industries, Chicago, it's offered in 18" and 24" blade lengths at about $1.65 and $1.80.

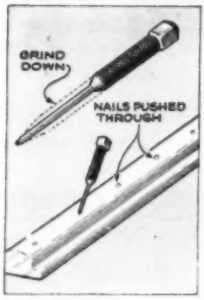
Hand Scraper. This tool is said to plane and smooth both wood and metal. A metal rod running lengthwise through the hard-rubber block holds eleven replaceable steel blades in V-notches. The free-moving blades thus help to clear the tool of clogging scraps. Swiss Laboratory, Cleveland, makes it.

Angle Plate. Adjustable to full 90 deg. and graduated for all angles, an angle plate made by Chicago Tool and Engineering Co., Chicago, can be used for drilling, milling, grinding, and many jobs that ordinarily would require special setups. Eight bolt slots are provided on the surface plate for holding work. The plates come in 6" by 6" and 9" by 9" sizes.

Homemade Candles Formed in Metal-Foil Molds

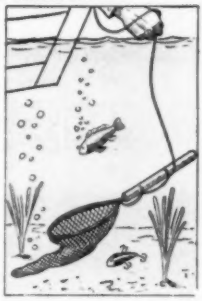
ALUMINUM or other metal foil, such as is used to wrap film, is easily fashioned into molds for candles. A glass may be used as a form to shape the foil. If the foil is backed by paper, fold the metallic surface inside. Stubs of old candles, paraffin from jelly glasses, or any other suitable wax is melted and poured in the mold. Insert the wick while the wax is still molten or make a hole for it with a heated wire after the wax has hardened. To hold the wick in place while the wax is hardening, tie the bottom end to a nail and the other end to a small stick that rests across the top of the mold. When the candle has cooled, peel the foil from it. An interesting surface effect is made by the crinkling of the foil. In the case of short, stubby candles, the foil may be left in place and trimmed with scissors or pinking shears to act as a decoration.

Nail Set Removes Moldings



A PRACTICAL way to remove moldings or quarter round without splitting or damaging them is to push the nails through. A tool for this purpose can be made by grinding down a nail set as shown in the drawing at left.—*Victor H. Lamoy, Upper Jay, N. Y.*

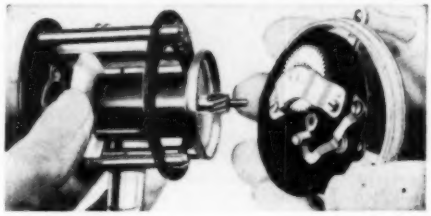
Net Locates Lost Lures

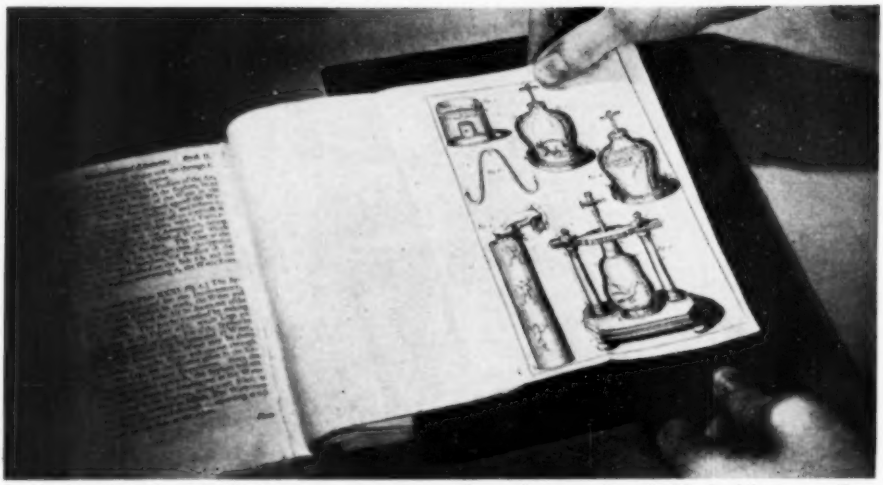


IF YOU lose a valuable fishing lure overboard, tie a stout line to your dip net and use it as a drag. The net, dragging over the hooks, will often become entangled with them. The lure then can be hauled to the surface.—*G. E. Hendrickson, Argyle, Wis.*

Reel Head Can Be Removed by Hand for Cleaning

NO TOOLS are necessary to remove the head of the Heddon Pal Reel®, making it easier for a fisherman to brush the mechanism with solvent and apply clean oil. The frame may be left attached to the reel seat while the head is removed. The maker, James Heddon's Sons, of Dowagiac, Mich., says the construction prevents the loss of small parts while removing the reel head.



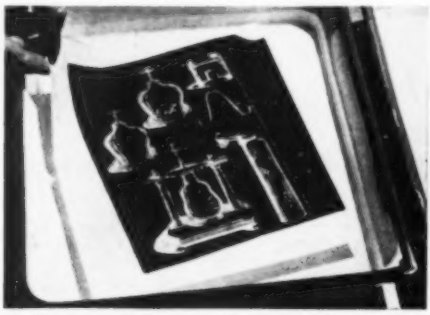


1. Back original with black to prevent anything on reverse side from printing through. Plywood covered with black felt is excellent for this. Heavy black paper can also be used.

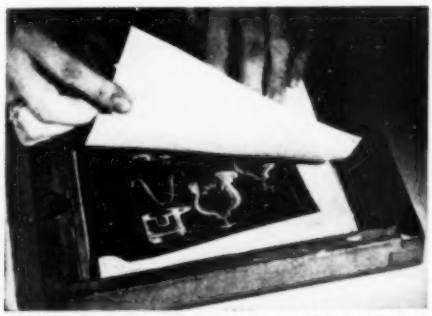
2. Put reflex paper, emulsion side down, on top of the face-up original. Cover with glass and press down while exposing to 100-watt bulb. Use a safelight while handling paper.

Copying Without a Camera

By Kenneth M. Swezey



3. Develop the paper about 30 sec., rinse in short stop, fix 10 min. in hypo, wash 30 min., and dry well. You then have a white on black negative. Note it's reversed left to right.



4. Black on white positive is made by printing through back of negative. Put it face down on sheet of face-up reflex paper on the backing board, or assemble in printing frame as above.

REFLEX printing is a handy photographic process to know even though you have no interest in photography as a hobby. With it, you can make quick copies of such things as letters, drawings, or text matter and diagrams in books and magazines.

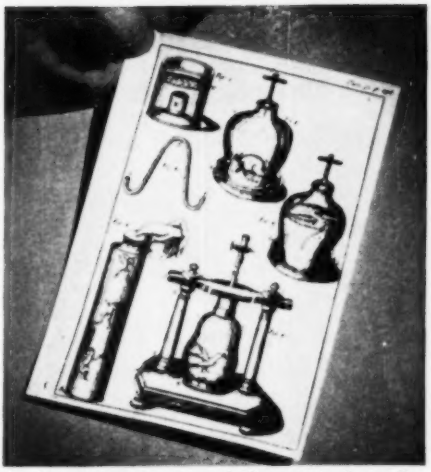
No camera is required. The main thing is a package of special reflex paper. This paper is thin and of high contrast. A sheet of plate glass, a felt-faced piece of plywood, and ordinary developer, short stop, and hypo complete your needs.

The job must be done under darkroom conditions. A yellow-green safelight may be used. You can probably get by with a dim red or orange bulb.

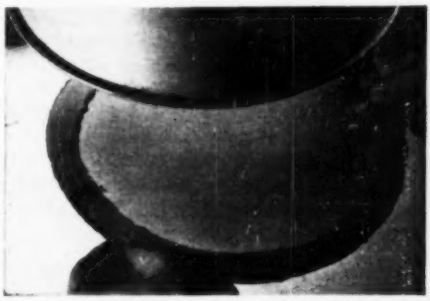
If what you want to copy is on thick or opaque paper, or has printing on the reverse side, you must first make a negative by the reflex method. For this, the original is placed face up with a sheet of reflex paper on it emulsion side down. Light thrown on the back of the reflex paper passes through and bounces back in proportion to the lightness of each area on the original.

For sharp definition, the original must be held firmly and evenly in contact with the paper. If there's any printing or design on the reverse of the original, it must be backed with black.

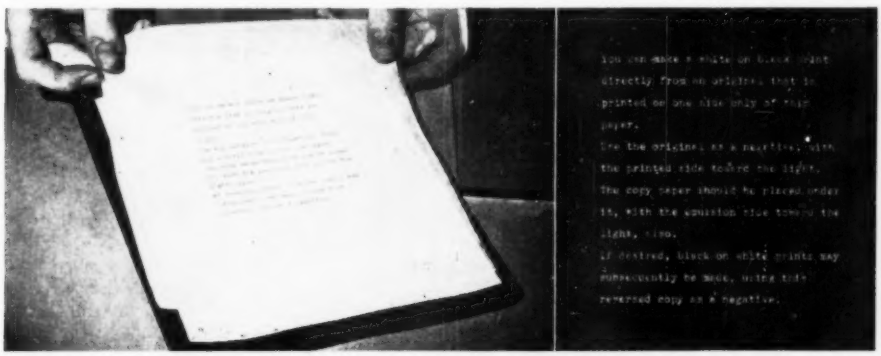
Make the exposure with a 100-watt bulb suspended above the paper. Exposure varies according to the bulb-to-paper distance and the nature of the original. After exposure, develop the paper for about 30 sec. at 68 deg. F. in a standard developer such as D-72 or Dektol®, diluted 1 part water to 1 part stock developer. Rinse, fix, wash, and dry. The result is a negative. To make a positive, use this as you would a film negative.



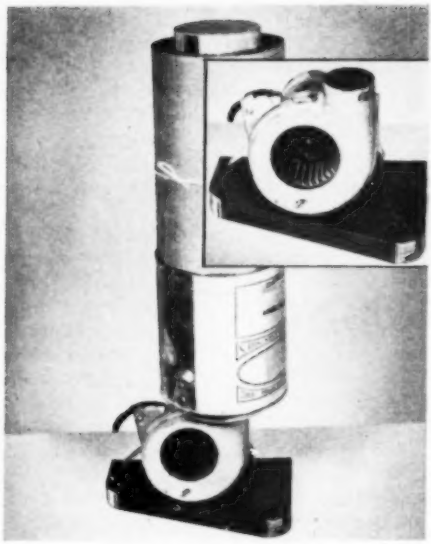
5. A contrasty copy of the original results. This positive is exposed and developed in the same way as the negative, but you may need a different exposure. A test strip will tell.



6. Use a yellow filter in front of exposure light if copying a blueprint or original that has blue ink. Yellow cellulose film glued to cardboard ring as above does the trick nicely.



If white on black copy will serve, you can use original as negative if it's printed on one side only of thin paper. In this case, the original and photographic paper must both face the light.

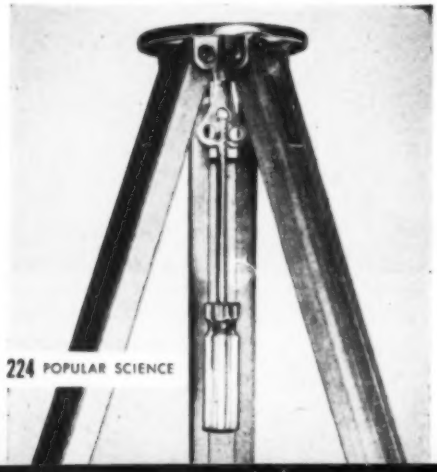


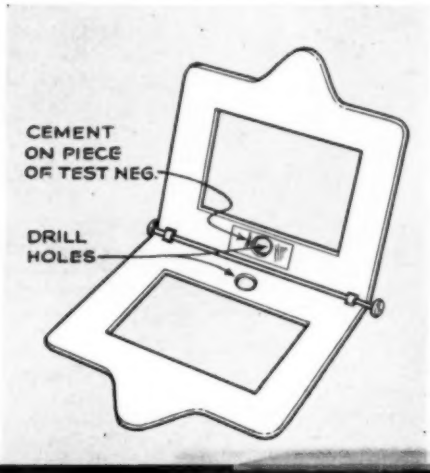
Condenser Improves Flash. The new Jen-Flash® above, made by the Jen-Products Company, New York, consists of a small capacitor and a hearing-aid battery. A charge stored up in the capacitor when a bulb is inserted makes it possible to use as many as four lamps without booster batteries. The current surge also gives foolproof firing even though the battery may be weak. The unit weighs only 8 oz.

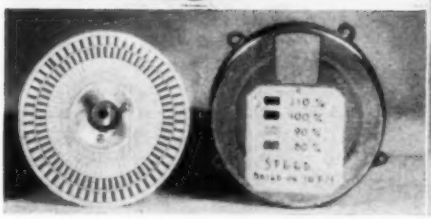
Blower Dries Prints. I've found this method of drying prints in a blotter roll very successful. A blower is mounted with the nozzle upright. One end was cut from a 1-gal. can and a nozzle-size hole cut in the other. This end is screwed to a wood doughnut that fits tightly over the nozzle. Wires across the can support the blotter roll. A wood disk closes the top center. *—Carl W. Thompson, Jr., New Castle, Del.*

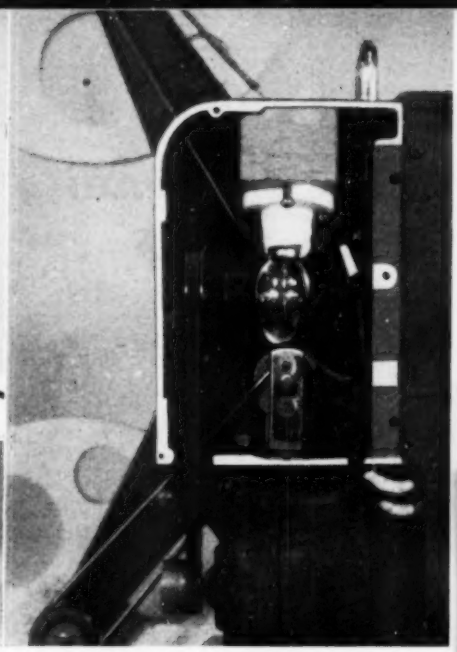
Handle for Tripod Screw. An extension handle for the screw on an old-type tripod can be made from a 6″ screwdriver. Soften the end of the blade by heating and letting cool slowly. Then saw off the tip and cut a slot about ½″ deep. Slip this over the screw key and solder in place.*—A. Trauffer, Council Bluffs, Iowa.*

Test Negative Aids Focusing. A dense negative is always difficult to get into sharp focus on the easel. A piece of thin, sharp negative cemented over one of two holes drilled in the carrier overcomes the difficulty. Pull out the carrier until the spot appears. Focus on this. Then push back carrier.*—Hugh Lineback, Stillwater, Okla.*









Speed Set with Stroboscope. A stroboscope is used in the General Engineering Laboratory at Iowa State College to show movies at controlled speeds. Above is a projector with stroboscope attached.

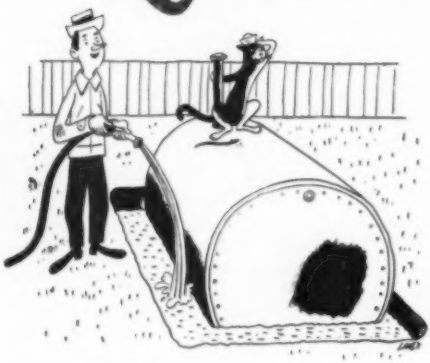
The 4″ stroboscopic dial, made of translucent paper, has four circles of radial lines. Beginning with the outer circle, the speeds are 110 percent of normal, 100 percent, 90 percent, and 80 percent. Each circle of lines is a different color. Spacing of the lines was determined by dividing the light peaks per second (120 for 60-cycle power) by speed of the sprocket shaft per second.

The dial is attached to an extension of the lower sprocket-wheel spindle. A neon lamp (see above) is mounted inside the projector back of the opening in the dial cover. A rheostat controls the speed of the motor.—*L. D. Henry, Ames, Iowa.*

Films Loaded in Army Bags. Two of the waterproof clothing bags now sold at war-surplus stores provide an inexpensive means of loading or unloading film holders. Fit one inside the other to avoid any chance of a light leak. Pull the top up under your armpits and lean forward while working.—*Tom Riley, Portland, Ore.*

Viewing Lens Improved. You get a clearer view of your subject on the ground glass of the Kodak Reflex II. Beneath the ground glass is an Ektalite Field Lens®. Made of plastic, this new type of lens more than doubles the overall illumination on the glass. Below are comparisons of the new (left) and the old.

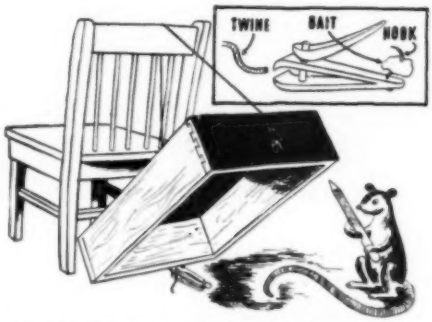
What's Your Ingenuity Quotient?



After digging all around a big storage tank that I wanted to remove, I found the soil underneath so pressure packed that I couldn't budge it. By then I was ready to blast the tank out except that I wanted it undamaged and I didn't have any dynamite anyway. So I filled up the pit with water. This not only loosened the soil but floated the tank to the top.—*Victor H. Lamoy, Upper Jay, N. Y.*

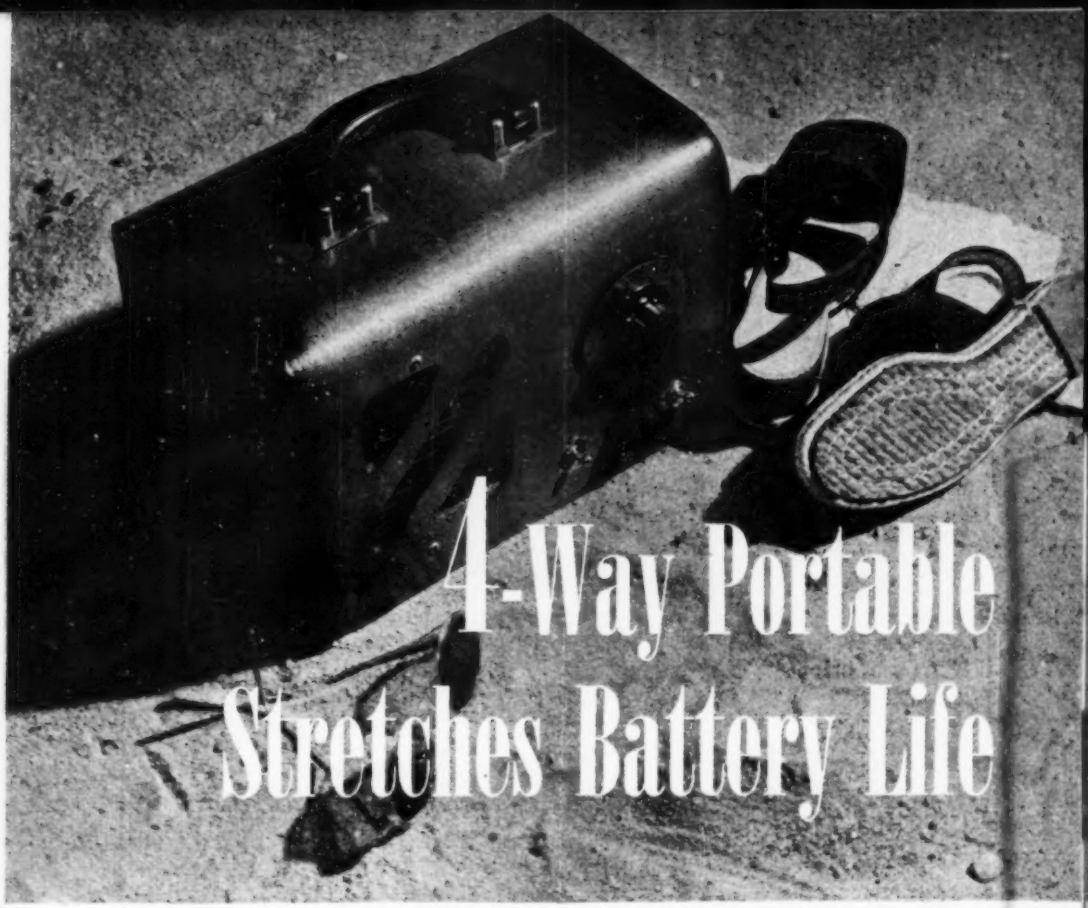
I was stuck but good. I had torn down the rocker arms, tappets, and push rods on my car. After cleaning up the parts, I put them back and started looking around for my .015" feeler gauge. I couldn't find it anywhere, and it was a Sunday, with all shops closed. Then one of my wife's old corsets came to mind. Using a micrometer, I picked out a steel stay that measured .015". That did it.—*Peter Crispino, Brooklyn, N. Y.*

A leak in my 900' pipe line could have meant a lot of digging since no water showed above ground. Just a pressure drop at the house. Instead of all that spade work, I capped the line at the spring and at the house. At the house I fitted an inner-tube valve in the plug and hooked my air compressor to the valve. Then I walked along the line. When I heard a bubbling sound, I had the leak.—*G. M. Small, So. Windham, Me.*



We had a smart-aleck rat. He must have trained in a rat-trap factory, since he knew all about ordinary traps and steered clear of them. However, I devised this snare that put an end to Smarty's activity. A wire hook both held the bait and also kept the nail clipper lightly closed on the twine. When the rat took the bait, he released the clipper and dropped the drawer on himself. —*Bruno Dias Souza, New Goa, India.*

Have you pulled off a smart one lately? We will pay for acceptable contributions showing ingenious solutions of problems in the home, shop, garage, or camp. It doesn't matter if it's wacky—if it works. Use government postcards only. Contributions cannot be acknowledged or returned.



4-Way Portable Stretches Battery Life

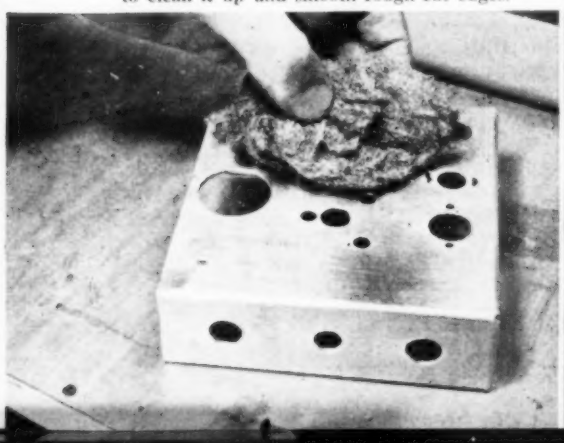
Getting ready for summer afternoons? A radio is almost as important as sunshine and water.

High and low battery positions as well as AC and DC operation give this versatile set surprising economy.

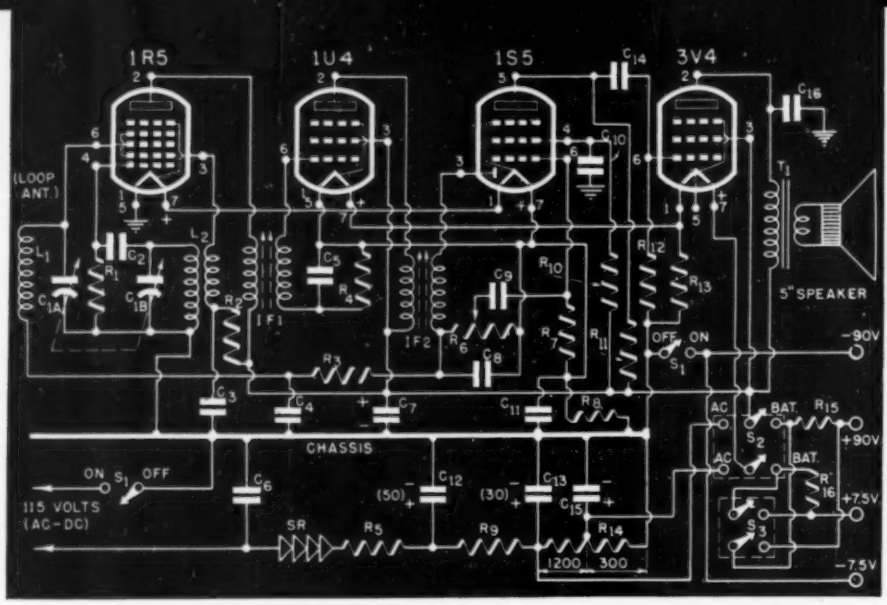
By Henry C. Martin

TWO resistors can make a big difference in a radio circuit. In the little set pictured here, they make a whopping difference in economy and battery life. You've seen standard three-way portables that operate on 90 volts of B battery or from an AC or

Plan the parts layout and drill the necessary holes. Rub down the chassis with steel wool to clean it up and smooth rough-cut edges.



Save space by joining small parts that go together—such as condensers and resistors in parallel—before soldering them into the set.



LIST OF PARTS

All resistors ½-watt carbon unless otherwise specified.
R1: 50,000 ohms.
R2: 6,800 ohms.
R3, R12: 2.2 meg.
R4, R7: 10 meg.
R5: 50-ohm, 10-watt wire-wound.
R6: ½ meg. potentiometer (volume control).
R8: 2,200 ohms.
R9: 200-ohm, 10-watt wire-wound.
R10: 3 meg.
R11: 1 meg.
R13: 150 ohms.
R14: 1,500-ohm, 25-watt adjustable wire-wound.
R15: 2,500 ohms.
R16: 20 ohms.
C1 A, B: Two-gang tuning condenser with cut-plate section for 455 kc. IF.
C2: 50-mmf. mica or ceramic.
C3, C5, C6, C9, C10, C11, C14: .01-mfd., 200-volt midget paper.
C4: .05-mfd., 200-volt midget paper.
C7: 20-mfd., 150-volt electrolytic.
C8: 100-mmf. mica.
C12, C13: 50-30-mfd., 150-volt dual electrolytic.
C15: 100-mfd., 50-volt electrolytic.
C16: .01-mfd., 200-volt midget paper.
S1: DPST switch on R6.
S2: DPDT toggle.
S3: DPST toggle.
T1: Midget output trans. (see text).
SR: 100-ma. selenium rectifier.
L1: Loop antenna.
L2: Air-core osc. coil.
IF1, IF2: Iron-core intermediate-frequency transformers.
Batteries (90 volts B; 7½ volts A), 5" PM speaker, tubes, sockets, cabinet, back panel, chassis, dial, line cord and plug.

DC line. Another common design is the "personal" radio that generally uses a 67½-volt battery to save space. Compactness is achieved, but at the cost of lowered sensitivity and volume.

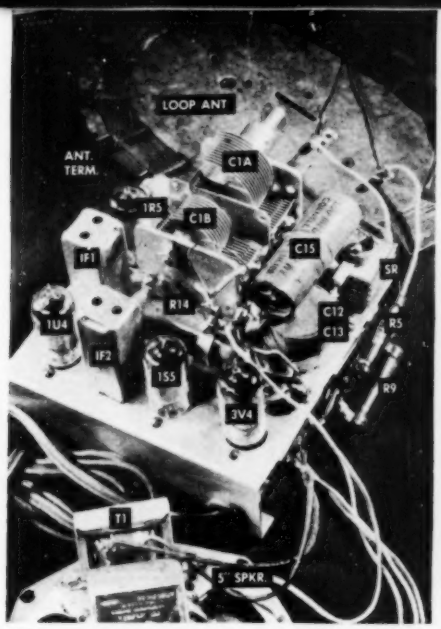
Here, for the first time, both circuits are incorporated in one set. Indoors you'll run this receiver off the house lines. When you get out of range of an extension cord, however, you'll find that packaged power not only delivers the goods but does so at a considerable saving.

The whole trick is in the addition of two dropping resistors and an economy switch. Using 90 volts of B battery and 7½ volts of A, the receiver performs with maximum sensitivity and volume. That's fine for a noisy beach or ball park, or when you want to listen to a far-off station. But most of the time you can get away with less power without noticing the difference. Flicking a switch reduces the potential from 90 volts to about 60, and from 7½ volts to 6. Current drain from the B battery is cut from 18 milliamperes to 7, while A current goes down from 55 to 45 milliamperes.

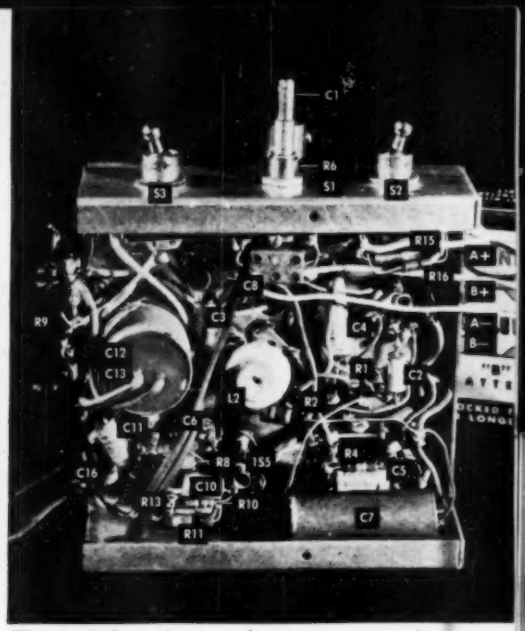
All of this means long, long battery life, for even after the cells have run down by a third, the set will continue to give first-rate performance if the economy switch is set up to maximum. To reduce battery drain, R15, a 2,500-ohm resistor is inserted in the B-plus line, and R16, a 20-ohm unit, is placed in the filament lead. When full power is needed, the DPST switch, S3, shorts out the dropping resistors.

A small 90-volt battery was used in this set in order to hold down size and weight. If you don't mind a slightly heavier package, you can get even greater economy by using two of the huskier 45-volt batteries in series.

Another feature of this set is a simplified rectifier circuit for AC-DC operation. It consists of a 100-ma. selenium rectifier, three electrolytic condensers, and three resistors.



Wire-wound resistors are mounted outside the chassis for better heat dissipation. One machine screw holds the selenium rectifier.



The dual-electrolytic condenser projects partly below and partly above the chassis. It is fastened on top by its mounting collar.

One of the latter, R14, is a 1,500-ohm, 25-watt unit with an adjustable tap. Setting the tap varies the filament voltage. It should be adjusted so that the tubes get about 7 volts—or even slightly less—when the set is being operated on house current. For testing, fix the tap to give a division of about 1,200 ohms to 300.

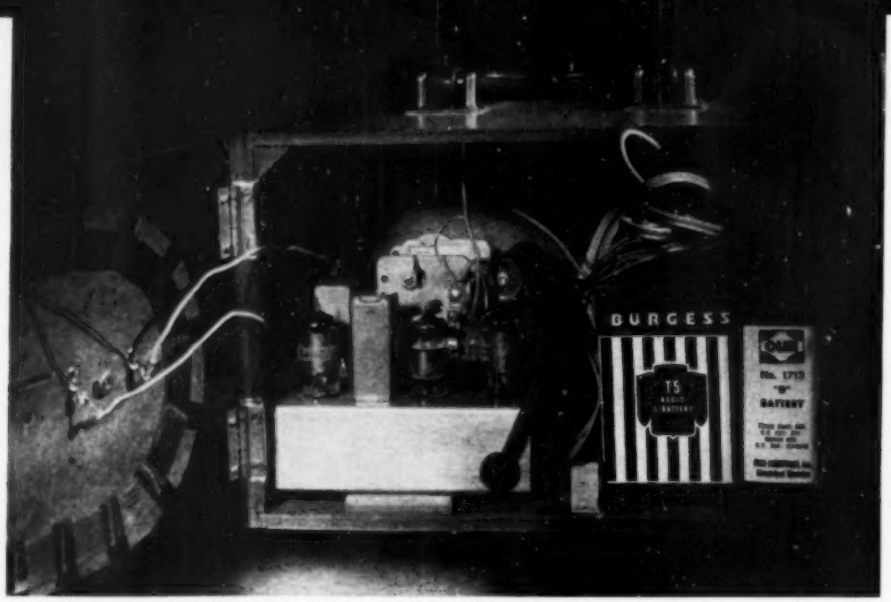
The balance of the circuit follows standard practice pretty closely. There are four miniature tubes in addition to the dry-disk rectifier, making this the equivalent of a five-tube superhet. The first tube, a 1R5, is a pentagrid converter that acts as an RF amplifier and local oscillator. The incoming signal is tuned by one section of the two-gang tuning condenser, C1; the other gang tunes the oscillator. Try to buy a condenser that has cut plates for the oscillator section, and built-in trimmers on both gangs.

The IF amplifier, a 1U4, operates at the fixed frequency of 455-6 kc. Two IF transformers, tuned to the same frequency, are also employed. Midget transformers with powdered iron cores were selected as iron cores give higher gain. It makes relatively little difference whether fine adjustment is made by means of air-spaced trimmers or by moving the iron cores. The diagram indicates a movable-core transformer, but the trimmer type may be more generally available and will work as well.

A diode detector and pentode amplifier are combined in the 1S5. The former demodulates the RF signal, the latter acts as a first audio amplifier. The 3V4 tube used in the output stage is a relatively new development; it was selected because of its effectiveness in amplifying weak signals and bringing them up to loudspeaker volume. Although this tube has a plate impedance of 10,000 ohms, it was found that an output transformer with an 8,000-ohm primary and 3.5 to 4-ohm secondary gave satisfactory matching. Transformers of the latter type are more readily available in small sizes.

An aluminum chassis measuring 1½" by 4¾" by 5" provided ample space. However it is always a good idea to assemble the parts for a set before finally determining the chassis size and arrangement. Aluminum is first choice for the chassis as it can be drilled and cut easily. Seven large holes had to be made for the tube sockets, the dual-electrolytic condenser, and the IF transformers. Socket holes are ¾" in diameter, those for passing the IF leads through the chassis are ½". The 50-30 dual electrolytic used here required a 1⅛" hole in order to be mounted, as shown, partly above and partly below the chassis. If you don't have chassis punches in the right sizes, drill smaller holes and file or ream them to the required diameters.

Solid pushback wire is the easiest to use



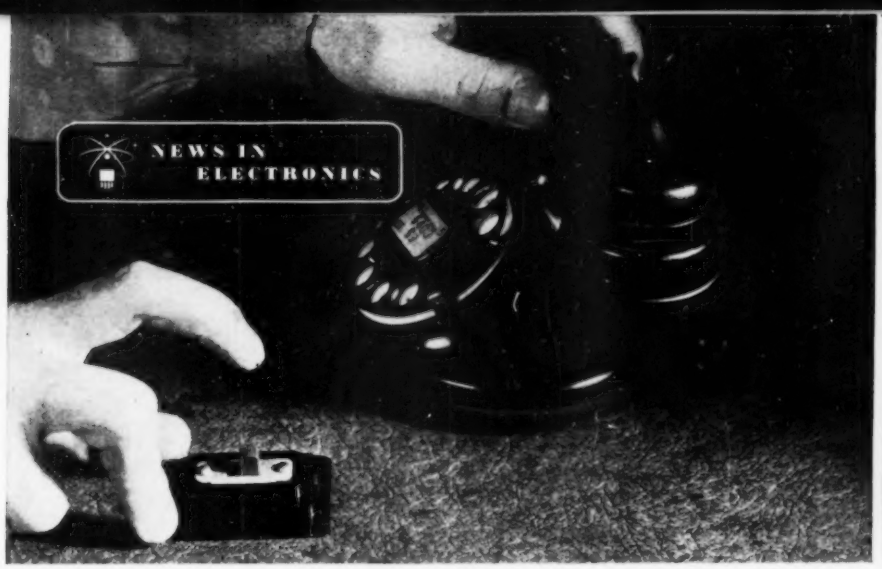
A small wooden cleat behind the chassis keeps it from sliding back in the cabinet. Cleats are also used to keep the batteries in place. For carrying, a leather handle is screwed on top.

for wiring the parts, and is suitable for all except the battery leads and those to R14. Cotton-covered stranded wire has the inside track for these connections where extra flexibility and current-handling capacity are important. Note that R5, R9, and R14 are all mounted above or outside the chassis. This is done because these resistors—all of the wire-wound type—generate more heat than could be readily dissipated if they were confined under the chassis. They only come into operation when the set is used on a 115-volt line. Should they appear to get too hot, it might be well to open the back cover when the set is kept on for long.

A dummy wall outlet is screwed to the side of the cabinet to provide an anchor for the AC-DC cord when the set is operated on batteries.

Although IF transformers are preset at the factory, wiring them into a set may throw them slightly out of adjustment. When the assembly is completed, tune in a station at the high end of the broadcast band (the plates of the tuning condenser are out of mesh at the high end) and rock the trimmers on the IF transformers very slightly to peak the signal. Use a small screwdriver for this adjustment, or, preferably, an insulated tuning wand. Make any similar adjustment that may be necessary on the trimmer alongside the oscillator section of C1. Rock the tuning dial back and forth while adjusting this trimmer, and then make a final check on a station at the low end of the band.

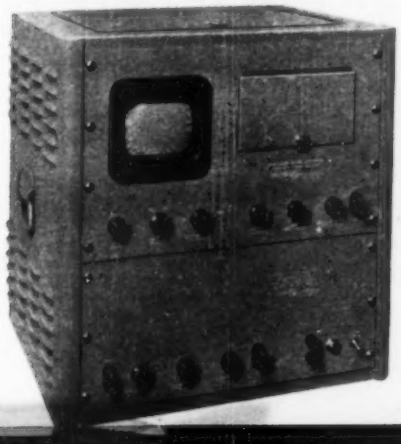
An inexpensive solution to the cabinet problem is to use one of the replacement cabinets for AC-DC receivers available at many supply houses. It isn't likely that any of them will come with carrying handles, but an attachable luggage handle takes care of that. Cut a plywood, plastic, or similar back to the proper size and hinge it to the cabinet along one edge. A loop antenna can be fastened to the back with a couple of screws. The speaker is attached directly to the front panel behind the grille, and the chassis is held by the two toggle switches, the volume control, and the tuning condenser. If necessary, tack in wooden cleats to keep the batteries from shifting inside the box. END



Switch Cuts Radio Volume. Phone conversations needn't be interrupted by loud radios. The Rad-lo®, sold by Nelson-Foote Mfg. Co., Boulder, Colo., consists of two wires that connect to the speaker and a switch that is placed near the phone. Other listeners aren't disturbed as the switch cuts volume but doesn't turn off the set.

Electrolytics Made Smaller. Stud terminals used in place of end rivets have resulted in reducing the size of dual electrolytic tubular capacitors. Aerovox Corporation, New Bedford, Mass., has introduced a new line of these condensers ranging down to 11/16" in diameter.

Instrument Analyzes Sound. Extending the methods of panoramic analysis (PS, Sept. '46, p. 196) from the radio-frequency to the audio-frequency spectrum, Panoramic Radio Corporation, New York, has introduced the Sonic Analyzer®. It automatically separates and visually measures the components of a complex sound wave.



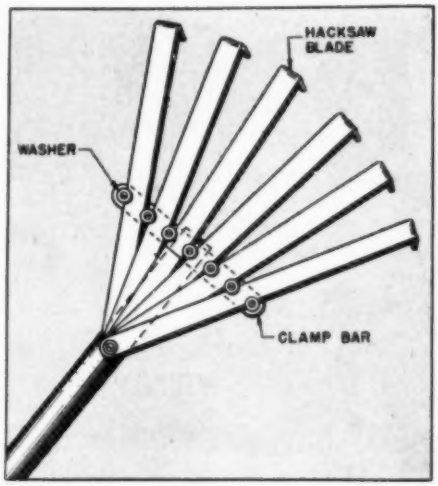
Device Reduces TV Mismatch. Electrical matching between a television antenna and receiver is improved in many cases by the Telematch®, made by Standard Transformer Corporation, Chicago. A 12-position switch allows the user to select the best antenna match for a particular station or location.

Lead Extends Meter Range. A DC voltage multiplier built into a test prod has been announced by Sylvania Electric Products, Inc., to adapt their previously released multitester (inset) for measurement of television high-voltage supplies. The lead is plugged into the meter case in place of the low-voltage probe and multiplies each of the DC ranges by 10, allowing for measurements up to 10,000 volts.

Baby Rides in Back Pack

PLANNING a hiking trip through a national park this summer, my wife and I wondered what to do with the baby, who has to go along. Here's how we solved the problem.

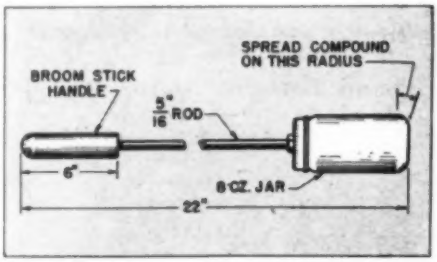
At a surplus store, I bought for 49 cents a carrying case intended for a field radio. Plywood was cut to fit the back, another piece installed as a seat, and a heavy wire, bent to U-shape, was secured to the front edge. The result is a portable "covered wagon." The case has several pockets for necessary extras.—*M. W. Bradshaw, Santa Rosa, Calif.*



Rake Made from Saw Blades

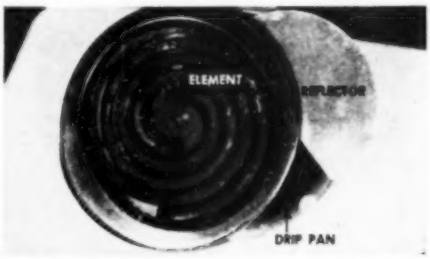
WITH half a dozen old hacksaw blades, you can make a small garden rake that's often useful in spots where you couldn't work with a larger one.

Break off the tip of each blade so you have a square end. Bend about ⅜" of this end to a right angle, heating first to soften the metal. The teeth may be ground off or left as they are. Fasten the blades to the handle with a bolt through the eyes. Space them on a drilled strap of iron with bolts and washers.—*C. H. Hardy, Los Angeles.*



Tool Refaces Flush Valve Seat

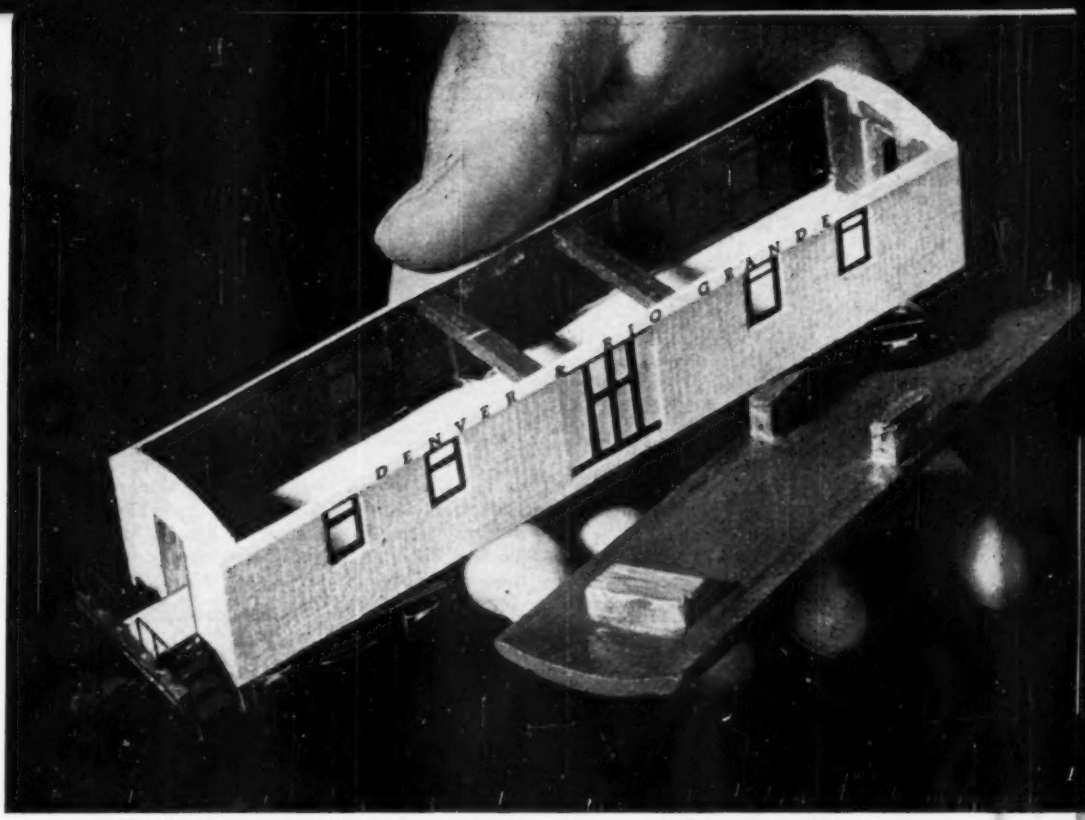
WHEN the valve seat in a toilet becomes pitted, a new ball valve doesn't always stop leaks. With the tool shown, I've been very successful in refacing such worn seats. I start with a coarse grade of auto-valve grinding compound, finish with a fine grade. Twirling the handle between my palms gives good grinding action. After several jobs, it's best to put on another jar since the glass wears thin.—*A. P. Muhl, Syracuse, N.Y.*



Reflectors Improve Old Range

MANY of the older electric ranges don't have the heating efficiency of the newer ones for a simple reason. They lack a reflector below the open-coil elements.

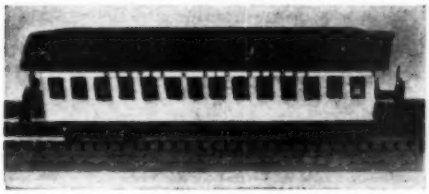
You can remedy this at little cost. Buy a few sheets of aluminum. After removing the drip pans from beneath the elements, cut aluminum to fit into the pans. Then replace the pans. Keep the reflectors bright by rubbing occasionally with steel wool.



Here's a baggage car for the locomotive shown last month. Below is matching passenger car.

Finishing Your Narrow-Gauge Train

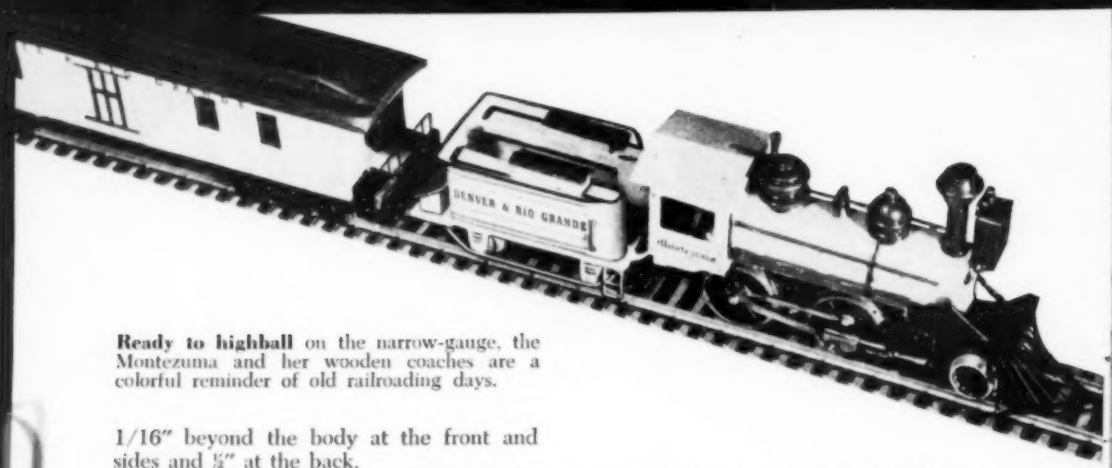
By George Walton



THE Denver & Rio Grande's Montezuma, for which plans appeared last month, had a four-wheeled tender. On this were mounted three tool boxes, which probably carried the usual engine tools, extra brasses in case of hotboxes, rerailing frogs to lift derailments off the ties, and chains to link up broken drawbars. On a road as rugged as the old-time D & RG, such emergencies weren't exactly rare.

All patterns are shown full size in the drawing, but only half of each appears. Lay tracing paper over it, trace off, and fold the tissue carefully along the marked center line. Place the folded sheet on a piece of face-up carbon paper and draw over the lines. Unfolding gives you a full pattern.

For the tender, cut a strip of .032" (1/32") sheet brass ¾" by 6" and mark off a section 1¾" wide at the center. Bend in two places to form an open U-shape. Then bend the two ends around a bit of ¼" rod to a ¼" radius, making the body 2" long and leaving a gangway ¾" wide. Solder this piece to the sheet-brass floor, which projects



Ready to highball on the narrow-gauge, the Montezuma and her wooden coaches are a colorful reminder of old railroading days.

1/16" beyond the body at the front and sides and ½" at the back.

A bit tougher to make is the flared rim around the upper edge of the body. It's probably easiest to solder on three 3/16" wide strips, one at a time. Round the ends of the side strips, cut all to a neat miter at the corners, and use a minimum of solder.

To the underside of the floor solder the journal boxes, which are simply sheet brass cut to the pattern given and bent on the dotted line to provide a soldering flange. Put a punch dimple in each to receive the pointed ends of the axles. I took these, together with insulated wheels, from an HO freight truck. Be sure to put the insulated wheels on the left side.

Two pieces of wood, with rounded ends, are cemented inside the upper edge of the body just below the flared rim. The two small tool boxes are glued to these. All the tool boxes are wood, with cardboard or sheet-brass lids, which project all around.

A loop of wire soldered at the front forms the coupling link to the pin on the engine. Solder a similar link and attach a standard HO coupler at the back of the tender. The steps measure 3/16" by ⅜". Solder them up from fine wire if you can't find ready-made ones of the right width. Finally, solder a strut of 1/32" wire (a straightened paper clip does nicely) from under the floor to the bottom of the journal boxes and back up to the floor on each side. This can be seen in the photo above.

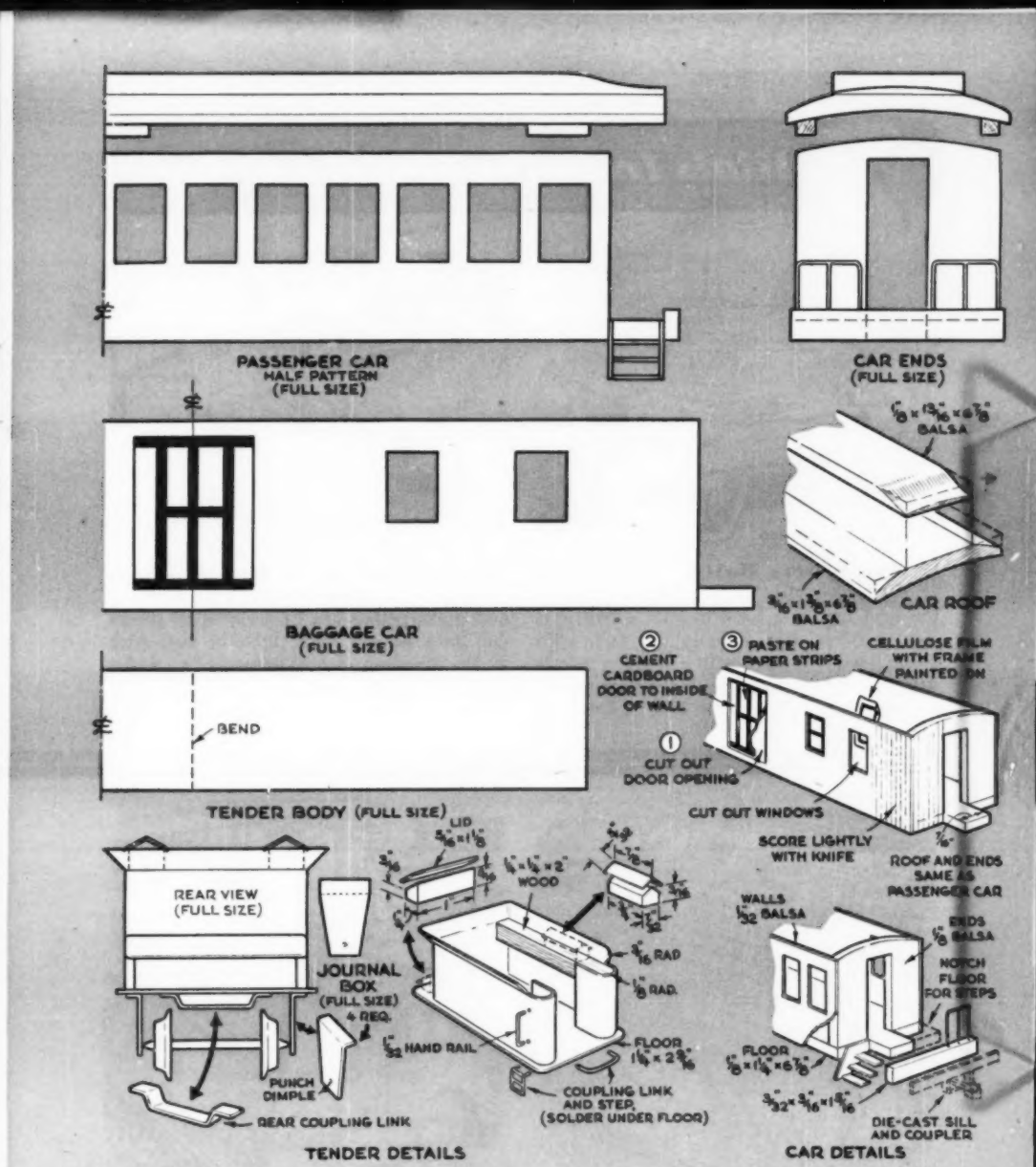
For the cars, I used balsa instead of sheet metal. They are light and put little load on the engine, but stand up well and look more like their wooden prototypes than metal ones would. The floor is a piece of ⅛" stock, notched for the steps at both ends, leaving a center platform 7/16" wide. Cement a balsa beam to this, and attach a purchased HO sill and coupler to the beam.

The car ends are ⅛" balsa also, with the doorways cut out. You can inset thinner stock to simulate the door proper, if you like. Sidewalls are 1/32" sheet, with all the window openings carefully cut out. Score these and the ends to represent the wooden construction of the day. Draw the sash frames on mica, cellulose film, or other transparent material and cement it behind the window cutouts. Glue in a couple of cross members from wall to wall near the top for bracing.

Build up each roof of ⅛" and 3/16" balsa. The rounded edges and sloping ends are quickly shaped with sandpaper alone. Small blocks glued to the underside locate the roof on the car. Space them for a push fit so that you can lift off the roof if you should want to add lights or interior details.

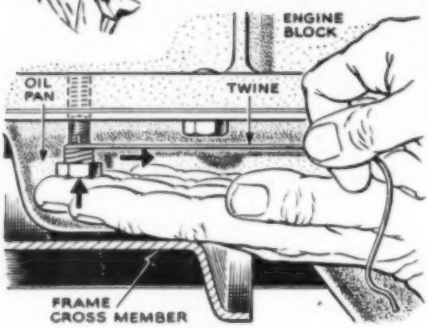
Platform railings are bent from thin wire or pins with the heads cut off. Make a U-shape, solder in a center post, and cement the assembly into the beam. Car steps can be made of .010" brass or thin cardboard. Underframe details such as brake cylinders can be bought ready-made if you want to add them. Pivot HO passenger trucks with insulated wheels on the floor by a single small wood screw each, leaving them free to turn easily. It doesn't matter what side the bushed wheels are on.

Use a consistent color scheme for the whole train. The cowcatcher, engine underframe, wheels, and cylinders are black. The body color of the locomotive and cars is a bright yellow, with medium green for trim. Handrails, running boards, domes, stack, and bell are all green. So is the striping. If you think you can't paint a straight stripe, lay colored self-adhering tape on a sheet of glass, and with a razor blade cut narrow strips you can stick on where needed. Other possible color schemes are red and gold, or medium blue and orange. END



You can trace full-size patterns directly from the drawings. Actual-size car and engine lettering also appears above. Recessed freight door is made as shown in the numbered steps.

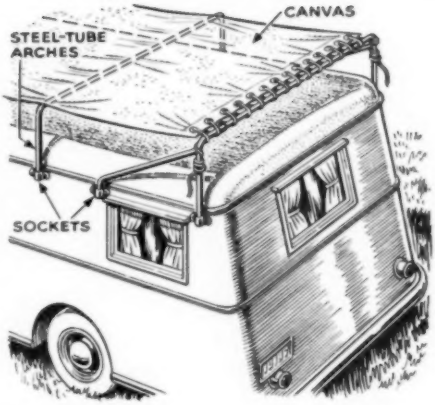
Hints from the Model Garage



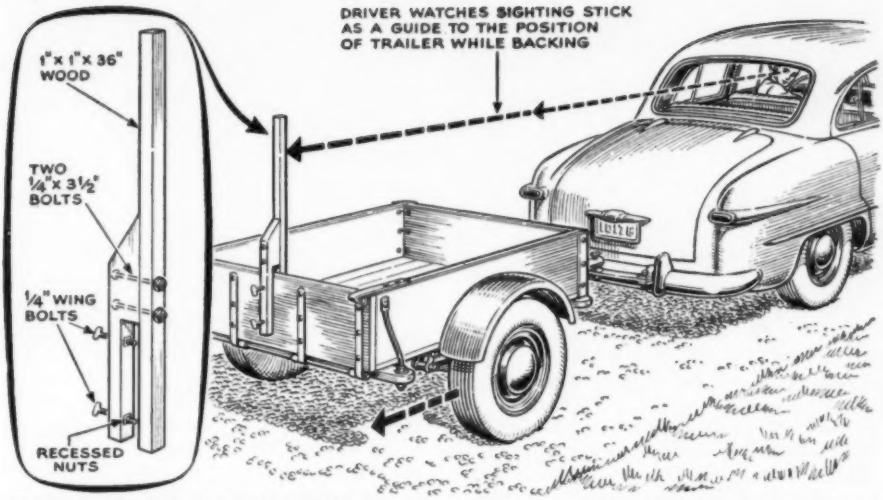
Twine Starts Bolts. Ben H. Clare, of Wellsville, Mo., suggests you use twine the next time you have to start a bolt in a hard-to-get-at spot. Wrap the bolt with twine, hold it in place with a finger or screwdriver and pull the twine. Sometimes it may be necessary to taper the end of the bolt.

Floor Pads Stop Drafts. Wind that blows in around the shafts of the clutch and brake pedals can be stopped by pieces cut from an old inner tube or step pad. F. W. Marasco, of McKeesport, Pa., writes that it isn't necessary to secure the slit pieces if you cut them large enough.

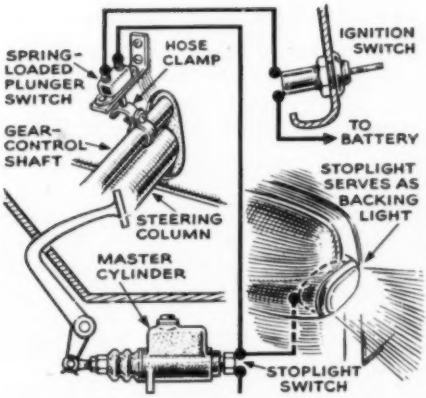
Keep an Auto Log. Adapt the idea of the airplane flight log to your car. Plane owners keep a careful record of engine checks and repairs, among other things. Put a notebook in the glove compartment and record lubrication, servicing, and overhauls. A date and mileage record of performance troubles, unexplained noises, or the like is often a source of clues for trouble shooting. A log also gives you a record of expenses.



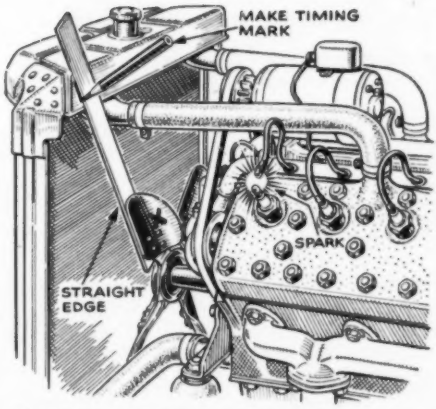
Awning Shades Trailer Roof. The interior of a parked trailer often becomes unbearably hot when the summer sun beats directly on it. To remedy this condition, A. V. Malone, of Los Angeles, built the shade shown above. It's canvas stretched over steel tubes that fit into sockets on the trailer. Mounted about 12" above the roof, it has open sides for air circulation, lowering the inside temperature 10 to 20 deg.



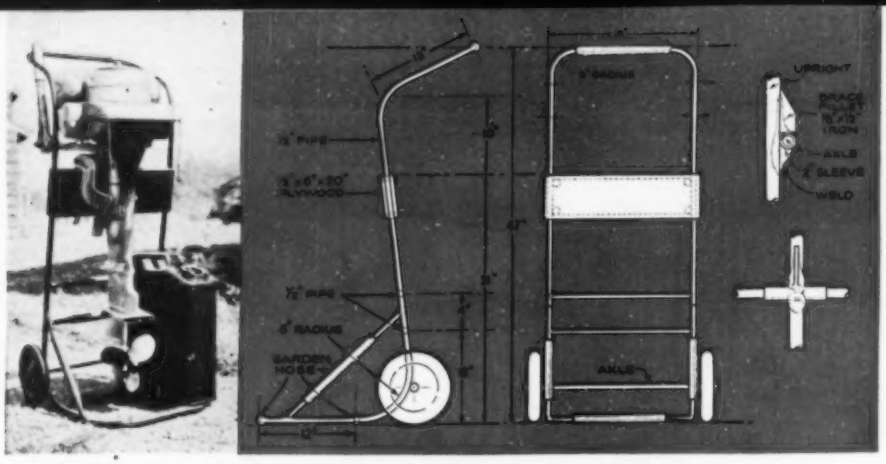
Guide for Backing Trailer. Anyone who has ever backed a two-wheel auto trailer will appreciate this simple guide to its direction. Suggested by Ralph S. Wilkes, of Keuka Park, N. Y., the directional guide is an upright hardwood stick about 1″ square by 3′ long and a clamping device. If you can't buy the wing bolts, make your own by heating the heads of ¼″ or ⅜″ machine bolts and flattening the heads with a hammer. The nuts are set into square recesses chiseled in the wood.



Light for Backing Car. F. W. Atwood, of Danvers, Mass., wired his stoplight so it serves also as a backing light. He mounted a spring-loaded switch on the firewall and a hose clamp on the shifter rod. Shifting into reverse turns on the stoplight. It's wired through the ignition so the car can be left parked in reverse. The motor can be started without the key (with shift in reverse and brake on), but this does no harm.



Ignition Timing Kink. Here's an easy method, writes H. W. Mills, of Albion, Ill., for checking the timing of a car with a direct-drive fan. Slowly crank the engine with the ignition on after disconnecting No. 1 spark plug. When you get a spark, use a straightedge on a fan blade to mark a spot on the radiator. Also identify the fan blade as well. This is mainly useful if one mark is made when the timing is just right.



Utility Cart Also Carries Outboard Motor

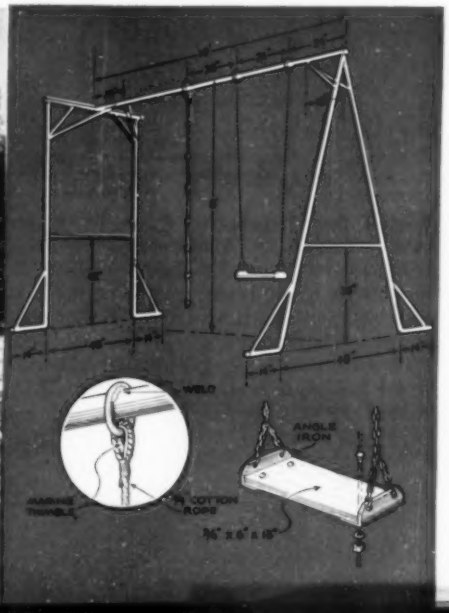
THOUGH I built this cart primarily for my outboard motor, I've discovered many everyday uses for it around the house. It hauls the ash can, carries groceries, serves as a portable laundry basket, and becomes a wheelbarrow with the addition of a box.

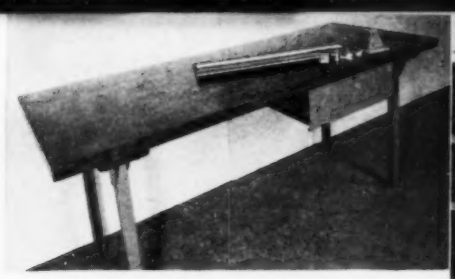
Construction details and dimensions are given above. Lay out the pattern on a floor. With a pipe bender or blocks nailed to the floor, slowly shape the pipe. Cut the cross-pieces to length and file the ends to fit the radius of the uprights. Then weld them in place. Old garden hose makes good buffers and a handle cover. Cut the hose to length, slit it, and tape it on the handle and the two braces as shown in the drawing. The ½" piece of plywood to which the motor clamps is bolted through the frame.

Any wheels from a small wagon or scooter will do, but semi-pneumatic wheels for a power lawn mower would be preferable. The larger the diameter, the easier they'll roll. The cart I built easily carries 300 lb.—*Lawrence L. Ames, Tacoma, Wash.*

Portable Play Equipment Welded of 2" Pipe

Two adults can move this play equipment from one spot to another to follow sun or shade. Built by Frank Motte, of Nuevo, Calif., 2" black iron pipe is used throughout with 1" pieces for the braces across each end and at the corners. All joints are welded. Rings to support the swing and climbing rope are welded to the horizontal bar. The rope is bound over a marine thimble to prevent chafing. Use only cotton rope; hemp may leave slivers in the hands. The structure is finished with aluminum paint.



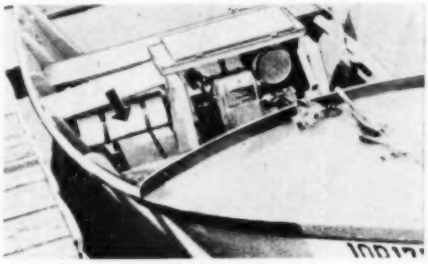


Steel Channel Makes Racks

WITH a hacksaw and a wrench, you can form these cold-rolled square steel channels into frames for workbenches, tables, storage bins, motor mounts, racks, supports for conduit and cable, and other utilities. Made by Unistrut Products Co., Chicago, the square channels have one side open. Once the framing is cut to required size, it's assembled by inserting a clamping nut in the continuous slot and tightening a cap screw. The nut may be inserted at any point along the strut. Two serrated grooves in the nut clamp to the ridges of the strut and automatically center the nut. It bridges the slot and forms a complete square where it's attached. An advantage of this type of framing is that it is re-usable. The parts may be reassembled in other forms. Made in five sizes from 19 to 12 gauge steel, the struts handle uniform loads up to 1,400 lb. over a 36″ span.

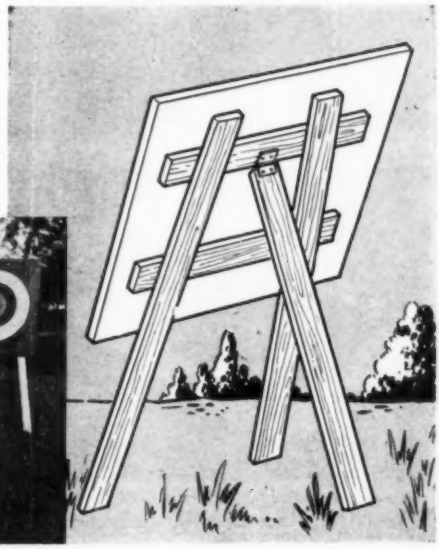
Asbestos Insulates Exhaust

ORDINARY asbestos pipe covering makes a neat, safe insulator for the exhaust manifold (arrow) of an inboard marine engine. Although the exhaust-pipe run is usually short, the bare pipe is still a potential source of burns and fire. Regular pipe covering used on home furnaces can be cut to length quickly and fastened in place with metal straps.—*Max Alth, Yonkers, N. Y.*

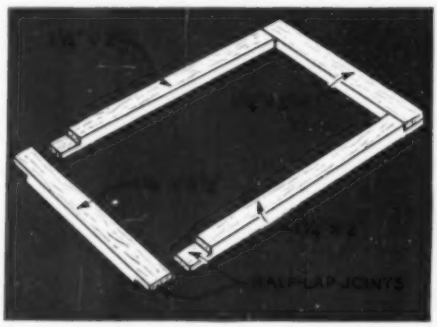


Dart Board Is Weatherproof

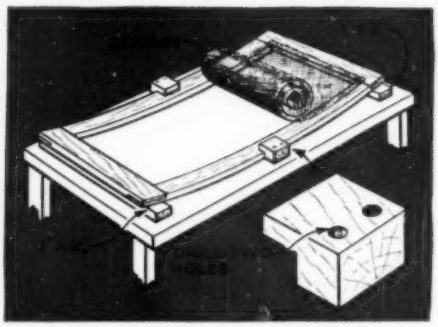
BUILT especially for outdoor use, the dart board pictured here can be left outside summer and winter in sunshine or rain. The 32″ square target area is asphalt fiberboard—the kind used as a liner when asbestos shingle is installed over old wooden shingles. A neighborhood contractor generally will let you have a single board for a nominal sum. The board may be nailed to a tree or the side of a garage, or mounted on an easel as shown here. The target circles are laid out with chalk or crayon and then filled in with a good grade of outdoor enamel.—*A. C. Nuessle, Newport, Del.*



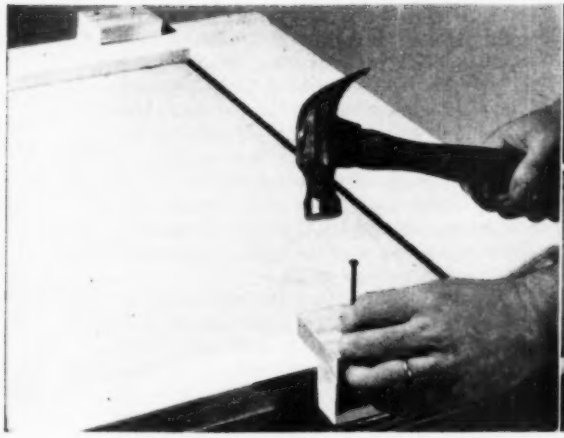
Building Your Own Screens

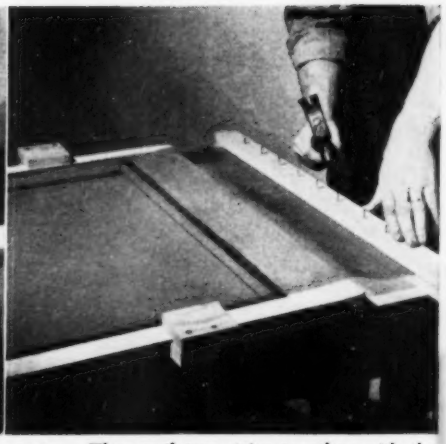


For screen frames avoid butt joints, which are temptingly easy but too weak. Half lap or mortise-and-tenon joints are much stronger.

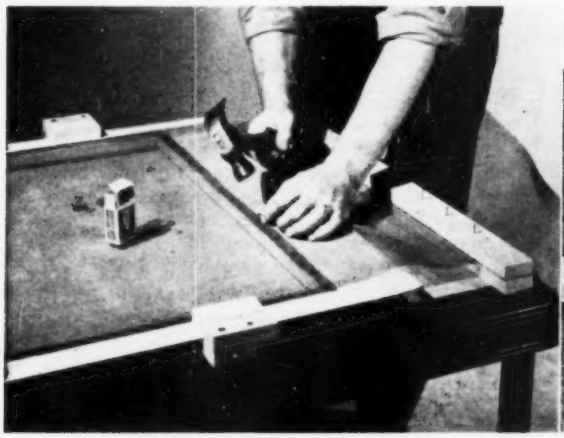


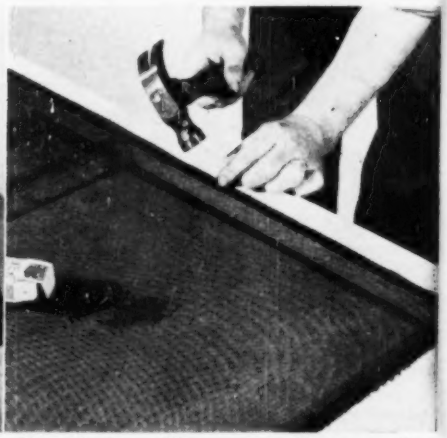
Here's one method of springing the frame to get the screening taut. Tack it at each end first, remove blocks, and tack the sides.





Screening also can be stretched by first securely anchoring the frame with C-clamps or wooden ones, as shown above. Tack screening at top. Then nail two strips together with the screening between. Pull the strips until the mesh is taut and nail them down temporarily.



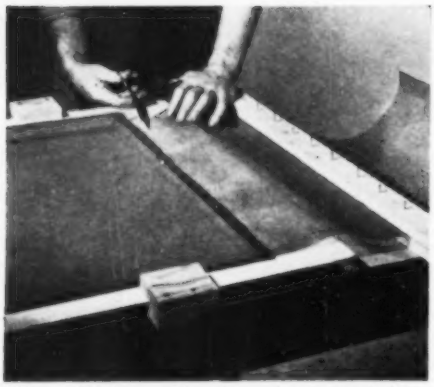


With the mesh held taut, tack along the bottom and then along the sides, as shown in these two photos. Plastic screening is easier to handle and, if you like, you can dispense with a stretching jig. Just tack it at one end, pull it tight, and tack the bottom and sides.

WITH a few simple tools and the necessary lumber, you can tailor screens to fit your windows and—just as important—save a big bite out of your budget. The tools you'll need are a hammer, saw, scissors, and perhaps a plane. Besides the lumber, you'll need tacks or staples and, of course, screening.

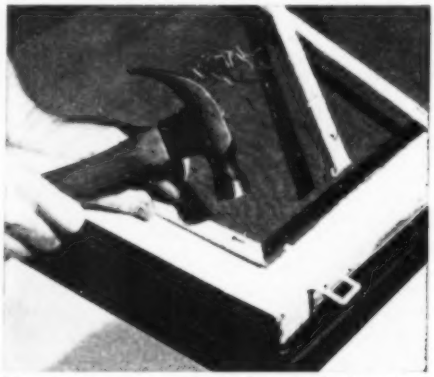
It'll pay in the long run to spend a little more on a good grade of lumber. You'll have sturdier, longer-lasting screens. White pine or redwood is suitable here. You have a wide choice of screen materials: steel wire finished with black japan, galvanized steel cloth, copper, bronze, aluminum, and plastic such as Lumite®. Here's another place where it'll pay to spend a little more. Steel wire will have to be painted from time to time and finally will rust anyway. Galvanized steel cloth will resist corrosion for a considerable time. Rust won't touch the others and they never need painting.

On the opposite page, a drawing gives you dimensions for the lumber and shows you where to saw for half-lap joints. You also can use mortise-and-tenon or miter



After all four sides have been stapled or tacked down, cut off the screening with shears. Ordinary scissors will cut plastic mesh.

Leave enough extra on plastic screening to let you fold over a hem almost as wide as the molding. This should be done on all cut edges.



To give your screens a finished look and to provide additional strength, tack ½" half-round molding along the edges.

joints. If the latter, strengthen them with angle irons. For accurate fits, measure each window casing before cutting the stock for the frames. Nail numbered tacks on each frame and window sill for identification. Use waterproof glue and brads in joining the pieces. By sinking the nailheads and covering them with composition wood, you'll avoid future rust stains. Sandpaper the frames smooth and try them in the casings. Plane down any uneven spots. Then apply two coats of outdoor paint.

Two ways of getting the screening on good and taut are given here. The method shown in the drawing on page 240 takes advantage of the springy nature of most frames. Instead of the notched pieces to hold down the frame, you can use C-clamps. If you do, protect the frame with a piece of scrap. After stretching and tacking the screening at both ends, remove the end blocks. The frame will spring back, stretching the screening very tightly. Then tack down the sides.

The other method—pictured on the preceding page—uses two 1" by 2" strips to pull the mesh tight. First, clamp down the frame. Then tack screening to one end. Roll the screening to the other end of the frame and hold it with the two strips as shown. Pull the strips to tighten the screening and nail the strips to the bench. Then tack across the end and along the sides. For a finished appearance and to give added support, tack ½" half-round molding along the edges, mitering the corners.

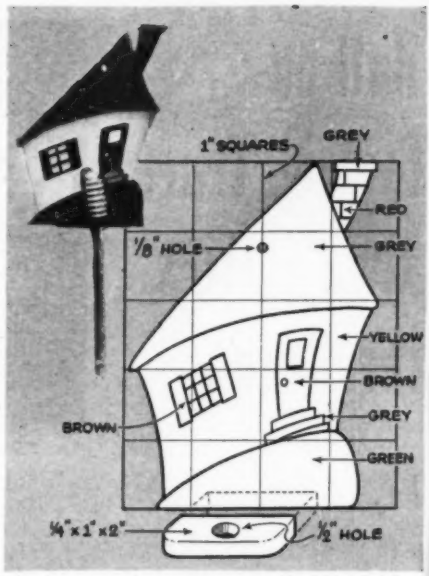
Plastic screening is somewhat easier to install since it is more flexible than the metals and can be cut with scissors. Also, it's much easier to handle than the metal. If you like, you can dispense with the stretching jig when using the plastic. Cut it to the size of the frame, allowing enough material at the cut edges to fold over a hem as wide as the molding. Tack through the hems.

Start with one end, putting tacks or ¾" staples about 1½" apart. Then pull it tight at the other end and tack it at each corner and across the end. Do the sides last, not forgetting the hem that helps keep the screening from unraveling. Tack on the molding and the screen is ready to install.

Metal screens should be taken down in the fall and stored in a dry place. Plastic screening is not harmed by dampness and may be left up all year round. Cleaning with soapy water is all that's necessary. END

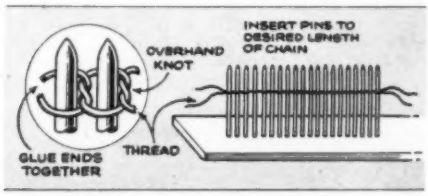
Toy House Holds Brush

This simple but brightly painted toothbrush holder will make a hit with most youngsters. Lay out the pattern on hard composition board or ¼" plywood and cut it out with a coping or jigsaw. Drill a ½" hole in a ¼" piece of wood and nail and glue it to the bottom center. This holds the brush. Give the cutout a coat of flat white. When dry, smooth it down with fine sandpaper. Use the squares as a painting guide. Color the roof gray, the front wall a bright yellow, and the ground a jade green. Carry the colors around the sides of the board. Once these colors are dry, you're ready to paint in the other parts. Use either gray or brown for the window and gray for the steps. Make the chimney a bright red with a gray toppiece. A pen is handy to paint in the window frames, the door, and the steps, and to outline the bricks of the chimney.



Telescope-Microscope in One

Built of lightweight aluminum-alloy tubes, this 60-power telescope does double duty as a microscope. When the five tubes are collapsed, the four lenses are positioned automatically for use as a microscope. The eyepiece is adjustable for magnifications of 15, 30, and 60 times. When fully extended, the 'scope is 33" long. It's priced at $4.50 by Brownscope Mfg. Co., New York City.



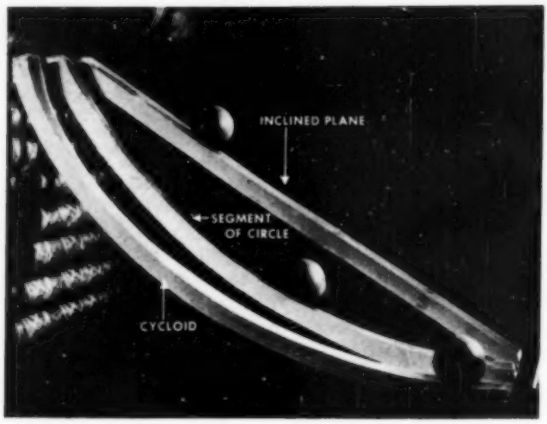
Thread Makes Model Chains

Black thread can be knotted into excellent imitations of chains for ship models. I first stick a row of pins through a piece of cardboard. Then I tie an overhand knot around each pin, as shown in the drawing. To finish the chain, glue the ends of the threads together and slip the chain off the pins.—*Jorgen A. Jorgensen, Storrs, Conn.*

Wheel Measures Trails

Needing a quick way to measure the roads, land, and hiking trails at my Maine fishing camp, I built the wheel pictured here. The circumference is 7½'. A revolution counter on the hub keeps tabs on the distance covered. To use it, a man just pushes the wheel ahead of him as he walks along.—*Chief Stanwood, Tunk Lake, Me.*

Ball on Cycloid Track Always Wins the Race

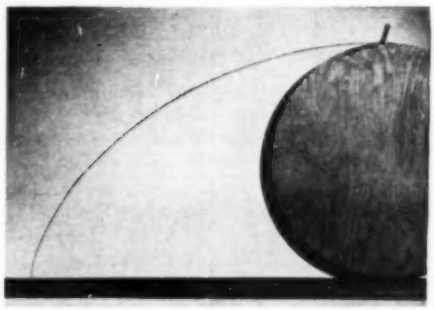


HERE'S a scientific puzzler. Like a free body falling vertically, a ball rolling down an inclined plane accelerates at a uniform rate. As Galileo demonstrated, the distance travelled is proportional to the square of the time of descent.

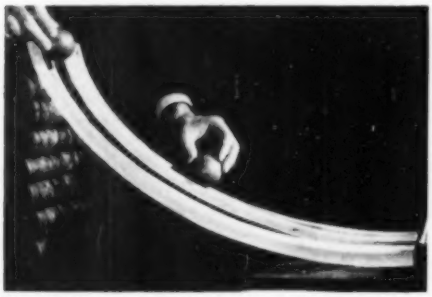
But this natural law no longer holds if the ball rolls down a curved path. If the track is concave, the ball accelerates most at the beginning of its fall. If the curve takes the form of a cycloid, the ball will reach the lower end sooner than it will the end of any other inclined track of equal horizontal distance.

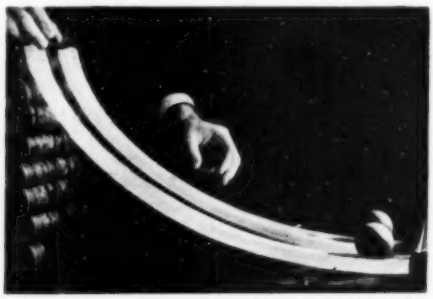
You can demonstrate this by setting up the race illustrated at the top of the page. Make the tracks of heavy cardboard, plywood, or wire. One path is a simple inclined plane, another a segment of a circle, and the third a cycloid.

According to the dictionary, a cycloid is a curve traced by a point on the radius of a circle rolling in a plane along a line in the plane. But don't let that confuse you. It's simple enough to lay out the half of a cycloidal curve you need. The photo below shows how it can be done.—*Kenneth M. Swezey, Brooklyn, N. Y.*



You can lay out a cycloid in this way. Tape a pencil to the edge of a large disk. Place the pencil and disk against a yardstick. Then roll the disk along the stick without slipping.





The ball catches up! Another odd property of a cycloid is seen here. Roll balls down identical cycloids. No matter where you start the balls, both reach the bottom at the same time.

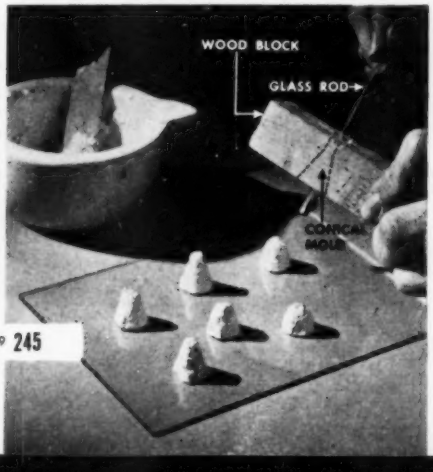
How to Make Pharaoh's Serpent Eggs

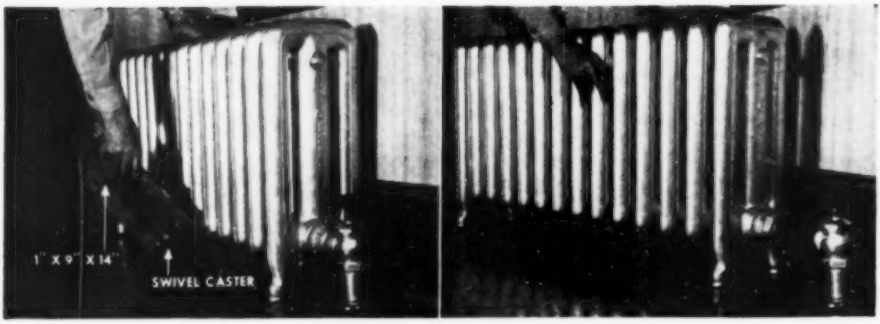
CHIEF ingredient of these serpent eggs is mercuric thiocyanate. You can buy it at chemical supply houses, or you can mix your own. Either way, wash your hands after handling it. It's poisonous. To make it, add several drops of ferric chloride solution to a saturated solution of mercuric nitrate. (It's poisonous, too.) Then add, little by little, a saturated solution of potassium thiocyanate to the mercuric nitrate, stirring constantly. A grayish precipitate will form. Keep mixing and stirring. The solution will turn red. Let it stand 30 minutes. Filter the solution. Wash the precipitate on the paper with cold water. Let it dry on the paper. To make the eggs, moisten the dried mercuric thiocyanate with water containing a pinch of potassium nitrate and a little mucilage. Mold the eggs to shape and let them dry.

Here are four Pharaoh's serpent eggs in action. Ash is about 50 times longer than the eggs.

Add mucilage and pinch of potassium nitrate to water and moisten dried mercuric thiocyanate.

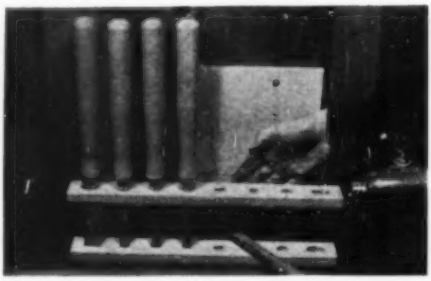
Drill and countersink conical mold for eggs. Hole permits eggs to be pushed out with rod.





Homemade Dolly Helps You Move Furniture

You'll find many uses around your home for a small dolly. Simply attach four swivel casters to a rectangular piece of wood, about 1" by 9" by 14". With this, I've handled a 300-lb. radiator quite easily. By building up the height with scrap boards, you can move just about any piece of heavy furniture. Use ball-bearing casters, preferably with nonmarring wheels.—*O. C. Grant, Springfield, Mass.*

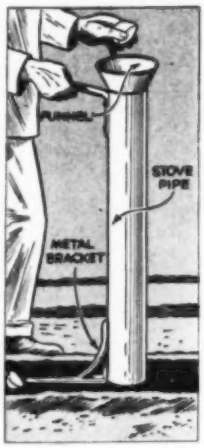


Chisel Rack Lets Chips Fall

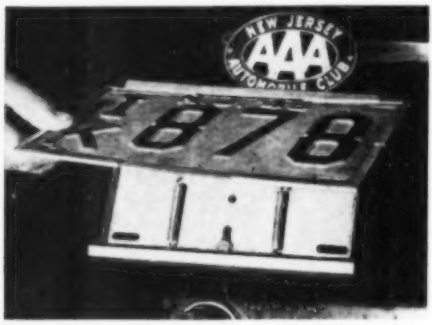
A chisel rack is handy right behind a lathe, but there it collects a mess of chips and shavings. If you space the rack about 1" away from the wall or backboard, the chips simply fall past it to the floor.—*Robert Hertzberg, Jackson Heights, N. Y.*

Seed Potatoes Evenly Spaced

If you've ever planted potatoes by hand, you know it takes a lot of stooping to do the job right. Here's a trick that enables you to plant them quickly and still avoid an aching back. Sling a bag of cut potatoes over your shoulder and drop them down the pipe, one by one, moving the planter forward each time a distance equal to the spacer on the bottom.



New Holder Allows You to Change Plates Easily

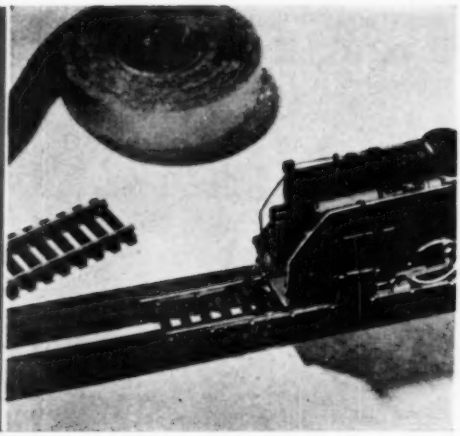


License plates are kept secure but you can change them easily if you use a new type of holder put on the market by the Ajay Specialty Co., of Newark, N. J. An aluminum frame for the plate is also provided.

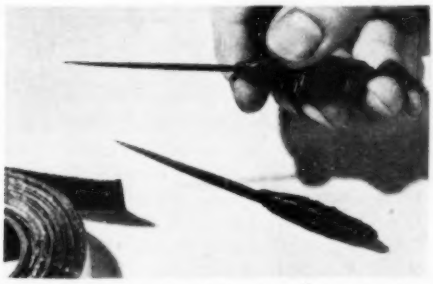
The holder itself consists of two main parts, each with a retaining lip along one edge. One is bolted to the license bracket. The other slips through a slot in the first and is held in place by two springs. The pull of the springs also holds the framed plate in place between the two lips. Holder and frame sell for $4 a pair.

Fix It with Rubber Tape

Scale down train noises. Model railroads laid on plywood may be noisy, or have a rattly, unrealistic sound. A rubber-tape roadbed under the track may help on both counts.

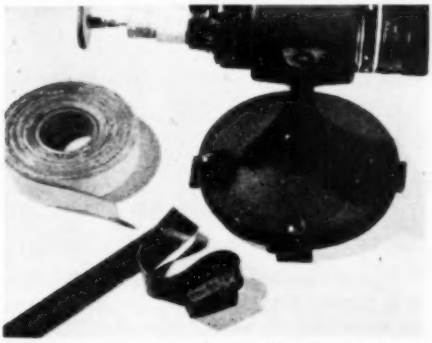


Do you keep electrician's rubber tape in your tool kit? Chances are you have the thin, black, tarry friction tape that's everybody's patch-all. But the other kind, a thick, live, stretchable strip, is handy too. Pull off the cloth backing, and you have a surface that sticks stubbornly to itself. The soft rubber hugs whatever you wind it on. Here are some uses for the stuff that have nothing to do with kilowatts.

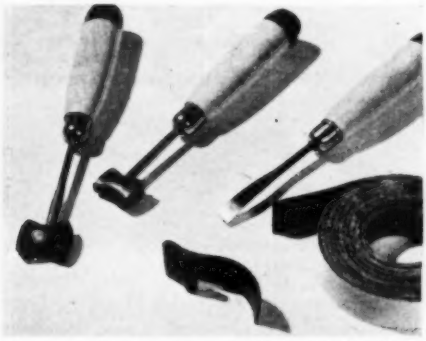


Give your fingers more room by wrapping handles on the shanks of fine jeweler's files.

Glass won't slip under the cutter if you lay it on strips of rubber tape stretched on the bench.



Folded tape pads under small power tools cut down vibration and creeping. Fold to several thicknesses and punch holes for mounting.

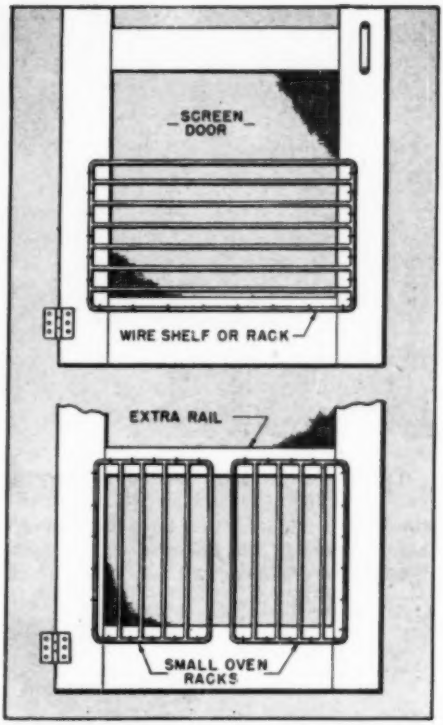


Preserve keen edges on fine woodworking chisels and carving tools by pushing on wads of tape. This helps prevent rusting too.

Yard Tractor Has One Wheel

BESIDES mowing your lawn, you can plow and cultivate your garden with this small gasoline tractor. Although it has only one wheel, it balances easily and steers by pressure on the pivoted handlebar. No tugging or lifting is required.

Made by the Bolens Products Division, Port Washington, Wis., it's known as the Huski Yard-Boy®. Clutch and throttle are controlled by the handlebar grips. A kickstand supports it when it's not in use.



Shelf Racks Protect Screens

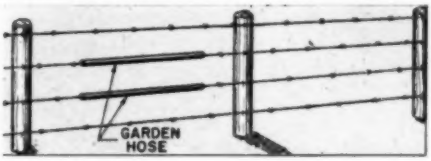
WIRE shelf racks taken from an old oven or ice box make excellent guards for the bottoms of screen doors that are apt to be kicked in by children or dogs.

If the available rack is long enough, just staple it crosswise over the bottom of the screen. Most likely, however, you'll have to work with smaller racks. These can be used vertically by installing an extra batten in the door.—*Victor H. Lamoy, Upper Jay, N.Y.*

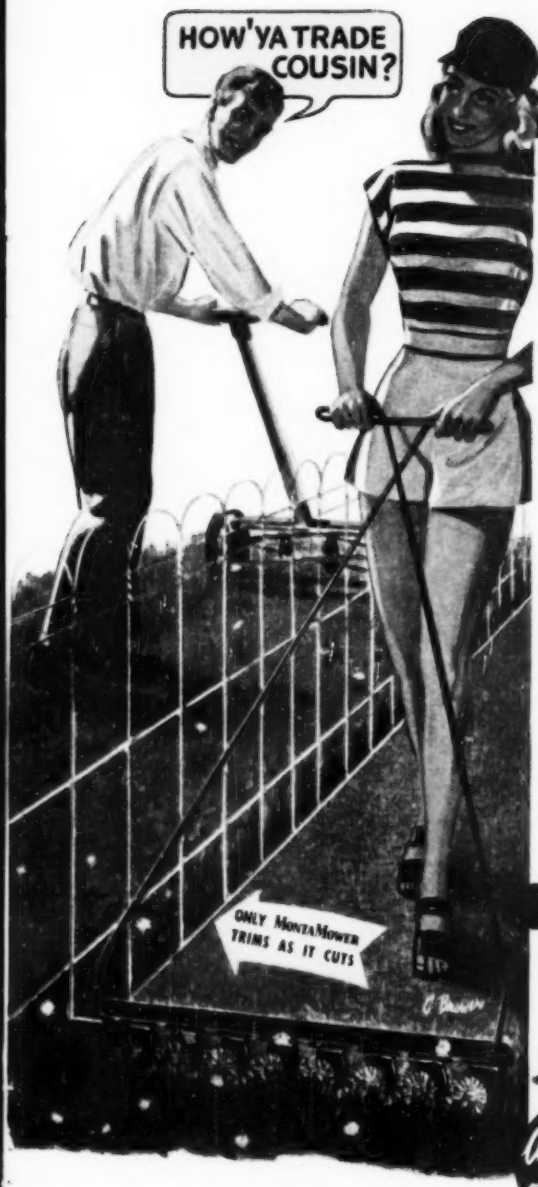
Steel Reed Tunes Instruments

STRINGED instruments are tuned visually with a tuner made by Ardell Mfg. Co., Long Beach, Calif. It's placed as above, the string strummed, and peg turned. When a steel rod in the unit reaches its widest oscillation, the string is in tune.

Garden Hose Prevents Rips



THERE's no need to install a regular gate in a barbed wire fence just for the sake of an occasional crossing. Instead, place two lengths of garden hose on parallel strands. You then can pass through without the threat of torn clothing.



MONTAMOWER *Mows and Trims* LAWNS

IN ONE EASY OPERATION

I wouldn't trade my MontaMower for a dozen ordinary lawn mowers!"

The above statement is a direct quotation from one of thousands of unsolicited testimonial letters received from MontaMower owners every year.

And little wonder MontaMower owners are so enthusiastic! MontaMower represents the first basic advancement in lawn mowing devices during the past half century. It is a new and different kind of lawn mower that mows and trims in one easy operation.

Actually, the MontaMower is a live, 8¼ lb. precision machine that smoothly and quietly cuts a full 16" swath through grass, dandelions, spike grass and tall lawn weeds (including the ones that ordinarily pop back-up to cause you extra work).

AND WHAT'S MORE – MontaMower does what no conventional mower can do! It cuts right up to walls, fences, trees and posts – practically eliminates hand trimming. It cuts under foliage, around flower gardens and close-quarter borders which cannot be mowed successfully with conventional hand or power mowers.

The MontaMower is so light, so sturdy and responsive, that even women and children can operate it easily and efficiently. Owners tell us that with their new MontaMowers they cut their lawns in half the time – with less than half the effort.

Learn these facts about the MontaMower from actual experience . . . it's sold under a liberal "Written Guarantee" which permits you to try it on your own lawn . . . makes you the sole judge of its merits. Get the complete facts about the moderately priced MontaMower, AT ONCE! **Just fill out the coupon below and mail it today.**

Weight only 8¼ lbs

Here's HOW IT WORKS

The new, improved MontaMower has eight pairs of sharp-edged, precision made and fitted, tool-steel cutting disks, slightly overlapping and self-sharpening, working as a unit. Each pair revolving toward each other gathers the grass and cuts it cleanly at the intersection of the disks. The new improved model is easily and quickly adjustable to cutting height! It's as modern and efficient as an electric razor!

The MontaMower is sold only by direct mail to users (no agents or dealers . . . no foreign sales at present.)

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Its distinctive styling goes far beyond just pleasing the eye. Here's design that flows naturally from advanced engineering . . . to fit form to function . . . to offer you a great New Plymouth that, inside and out, is better in every way!

Beauty with Reason

That sweeping, new low silhouette is something to see. And this is beauty with a reason. It helps give you a car that's easier to use in all ways. Easy to start—easy to drive—easy to park—easy to see out of.

Beauty for Comfort

The beautiful new interior styling is even better than it looks. The famous chair-height seats are now even wider. There's plenty of room for long legs and high hats. Windows lift and lower easier.

Beauty for Safety

The increased glass area is nice to look at from the outside. But it's there to **look out of** from the inside. Both windshield and rear window are larger. You get a clear, undistorted view of the road.

Just your style!

Special De Luxe 4-Door Sedan with Longer 118" Wheelbase

the great new Plymouth

For More Safety

New body construction makes the New Plymouth a sturdier, safer car. Frame and body are 23% more rigid. The New Plymouth has a lower center of gravity. It hugs the road better. And it handles with ease.

Beauty for Performance

There's a more powerful engine. This is the result of a newly designed cylinder head, increased compression ratio and a new intake manifold. New chrome compression ring gives even longer engine life.

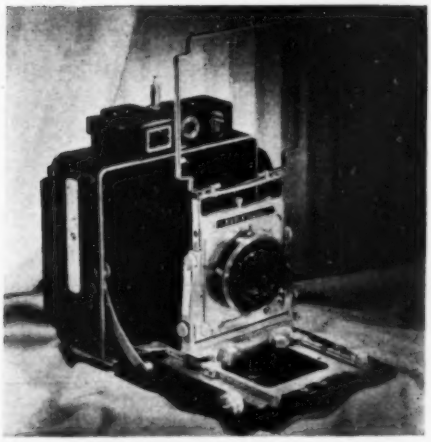
Beauty for Value

To see how new car beauty helps make a better new car—see your Plymouth dealer now! You'll find that the great New Plymouth—feature for feature, dollar for dollar—hits a new high in automobile value!

NOW there's more difference than ever in low-priced cars—and the great New Plymouth makes the difference. See this new car at your Plymouth dealer's now.

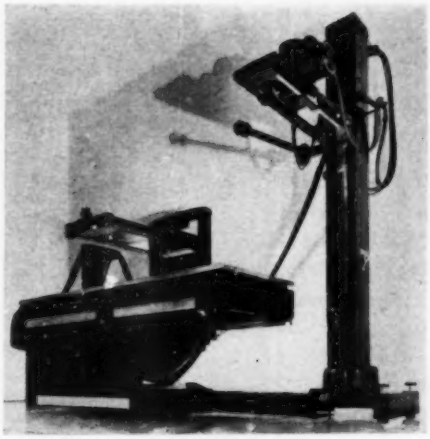
PLYMOUTH BUILDS GREAT CARS

PLYMOUTH Division of CHRYSLER CORPORATION, Detroit 31, Michigan



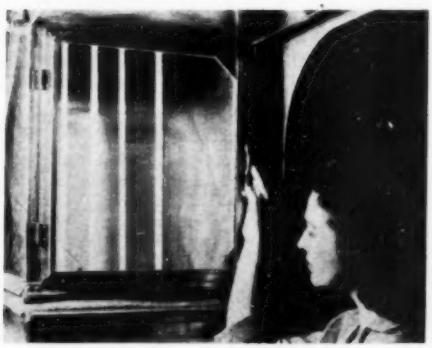
Camera Focuses Easily

A SINGLE viewer in this all-metal, 4 x 5 press camera lets you make all focusing adjustments without taking your eye from the one window. Called a Vue-Focus®, the new viewer combines optical view finder, range finder, night-focus light, and automatic parallax. The camera, made by Busch Precision Camera Corp., of Chicago, has a revolving back that locks automatically in 90-, 180-, 270-, and 360-degree positions.



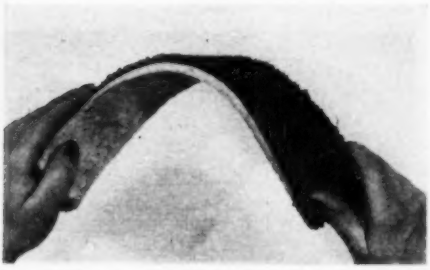
X Rays See Deeper

To give doctors clearer pictures of your insides, GE has stepped up the power of this new diagnostic X-ray apparatus from the conventional 100,000 volts to 130,000. Yet added safety devices, including an automatic exposure timer, give both the patient and operator increased protection against excessive radiation. The new equipment called the Maxiscope 500®, can be used for either fluoroscopy or X-ray photography. A pedal-controlled, variable-speed motor tilts the table to the desired angle.



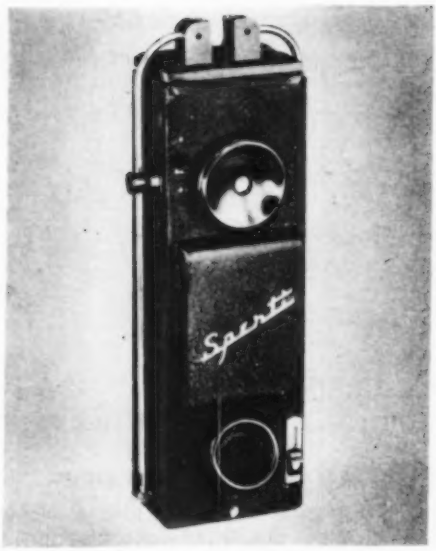
Lamps Purify Air

IF these tubular, germicidal lamps are used with your hot-air heating system, you can be sure the air you breathe is pure. Before recirculation through the ducts, air is exposed to the lamps' ultraviolet rays to kill any germs. Made by Westinghouse, the tubes are said to be as powerful after a year's burning as when new. Shown installed in a basement, the lamps shut off automatically when the glass door is opened.



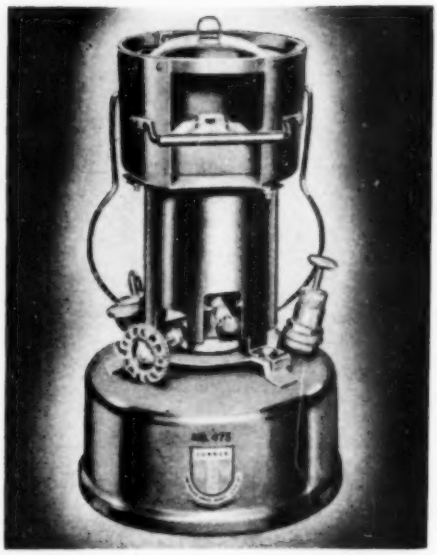
Rubber Resists Fire

A NEW, low-cost sponge rubber that won't burn can be applied and vulcanized directly to rugs, upholstery, and shipping cartons. Called Spon®, the compound can be shot from a hose, cast in open molds, or run off in sheets. The photo above shows how it is used to back a carpet strip. Developed by the Commonwealth Engineering Co., of Dayton, the material is also used for insulation and soundproofing.



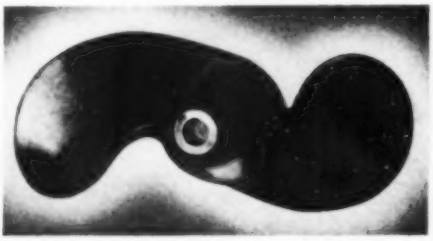
Two-Way Portable for Hams

THOSE tiny, two-way portable radios widely used in front-line communications during the war are now being made for amateur and public-safety use. This 3¼-pound, battery-powered Sperti model operates on two bands, 144 and 148 mc., and has an average range of three miles over flat or slightly rolling country. Only 10 inches high, it has a folding dipole antenna or can be connected to a fixed antenna for greater range.



New Fire Pot for Tin Workers

TINNERS need not interrupt their work to refill this new gasoline-burning Turner fire pot—it will burn for nine hours on one filling of its gallon tank. A special "carburetor" control permits regulation of the fuel supply for the best combustion at different heat requirements. The flame control, which adjusts the heat to the desired amount, also cleans the burner orifice automatically, eliminating manual cleaning.



Rubber Boat Prop Is Tough

DRIFTWOOD and underwater obstructions, the bugaboo of boat propellers, are no problem for this Goodyear rubber outboard propeller. Made around a metal core, it is stiff enough to drive a boat yet so resilient it bounces harmlessly off objects that would damage an ordinary metal propeller or shear the drive-shaft pin. It is also said to slide easily over weeds without fouling. The one above is for a 2½-hp. outboard motor.

Thickness Gauge Fits Pocket

WANT to know the thickness of a piece of paper, sheet of metal, pane of glass? This watch-size gauge will tell you at a glance. Made by the B. C. Ames Co., it will measure any material up to 5/16 of an inch thick. The material is inserted between the two contact points at left, and the large hand indicates the thickness in .0005-inch graduations. The small hand counts revolutions of the large hand, each equal to .05 inch.

Famous 35mm. Miniature

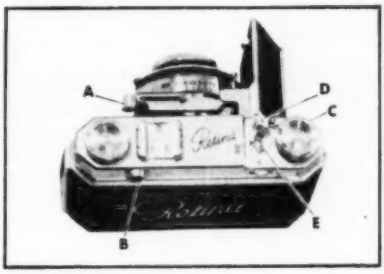
...now finer than ever

Ultra-fast f/2 coated lens. Ask your Kodak dealer for a demonstration of this famous Kodak miniature. $197.75, including Federal Tax.

All ready for action with ultra-fast Schneider Xenon f/2 Lens and Compur-Rapid 1/500 Shutter—nine speeds plus *bulb*. Uses black-and-white Kodak 135 Films and Kodachrome Film.

New all-in-one view and range finder. Figure **1** shows subject *out of focus* with two images in the center area. Figure **2** shows subject *in focus* with one image superimposed on other.

Finger-tip operation means easy control of the camera and a better picture on every shot. **A,** focusing knob; **B,** single view-and-range-finder window; **C,** film-wind knob (with automatic film stop and double-exposure prevention); **D,** shutter release; **E,** automatic exposure counter.



Extreme Compactness—folds up to fit small pocket or handbag. Built for long life—with strong but light die-cast aluminum alloy body and pin-grain leather covering. Its handsome design and watchlike workmanship are unique features. You'll like its solid feel and balance.

Also ask your dealer to show you the Kodak Retina I Camera with f/3.5 lens, a wonderful buy at $72.75, including Federal Tax. Trim and sleek in styling. One look will convince you of its value.

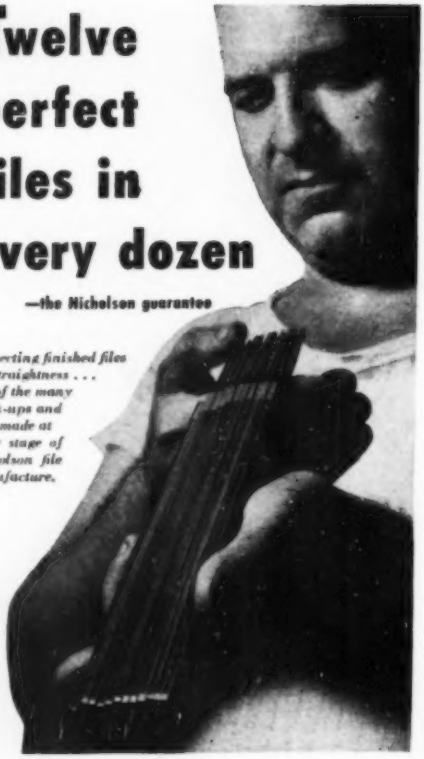
(Prices subject to change without notice) *"Kodak" is a trade-mark*

Kodak

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

Twelve perfect files in every dozen

—the Nicholson guarantee



Inspecting finished files for straightness . . . one of the many check-ups and tests made at every stage of Nicholson file manufacture.

WE *have* to make good files or we could not make good on that guarantee. A "perfect" file is one which in practical use does the best job that is possible through being precisely straight, carefully balanced, uniformly hardened, accurately cut (with teeth even in height and sharpness), and made of the finest file steel obtainable.

Nicholson has had 85 years of experience in manufacturing files *exclusively*. Every Nicholson or Black Diamond file is designed, made and tested to give you the best file performance, the longest file life, and therefore the most file value. There's more satisfaction in making files that way, because we know there's more satisfaction in using them. As a craftsman you'll agree that makes a lot of sense. At good hardware stores throughout the continent.

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COMPRESSED AIR

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BUY ONE NOW!

Mechanics and craftsmen will welcome the Master Tufboy's accuracy and rugged construction. Its blade, of the finest tempered spring steel, has clearly etched graduations and its case is made of the toughest chrome-plated zinc alloy which will withstand the roughest kind of treatment. You will find the Master Tufboy at your local hardware or building supply dealer or if you prefer, use the coupon below.

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I enclose ☐ $1.35 for the 6 ft. Tufboy
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OFFERS CAR AND TRUCK OWNERS EVERYWHERE THE SENSATIONAL ADVANTAGES OF A

Resistor Type SPARK PLUG

Now standard equipment on 6 leading makes of cars and trucks

AUTO-LITE MEANS PRECISION MANUFACTURING

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Wider spark gap helps eliminate occasional missing.

★ **IMPROVED GAS ECONOMY**
Permits burning of leaner mixtures and reduces misfiring.

★ **INCREASED ELECTRODE LIFE**
Up to 200% and more.

★ **IMPROVED RADIO RECEPTION**
Reduces plug interference with radio, radar and television within 35 mv/m from 540 kc. to 150 mc. at 50 ft.

★ Because of its low rate of electrode erosion, the new Auto-Lite Resistor Spark Plug permits wider initial gap settings and makes these advantages possible.

ALREADY OVER 11,000,000 IN USE IN CARS AND TRUCKS EVERYWHERE!

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ARE MADE TO LAST AND DO JOBS FAST

You'll see years of extra service from a Plumb hammer. The special analysis steel head has four points of hardness. The claw you swing is tempered and pointed and swing. The body or "eye" is tempered to absorb shock. The split in the claw is tempered to bite into nails and grip tightly. And the head is hardened to withstand pounding. Then, too, the Plumb hammer works faster. It's got a perfect balance that lessens fatigue, lets you deliver straight, accurate blows.

For value and quality choose PLUMB
For speed and workmanship, use PLUMB

The red handle with the black head —exclusively Plumb.

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HAMMERS · HATCHETS · AXES · FILES

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At Paint, Hardware, Dept., and 5 & 10c Stores

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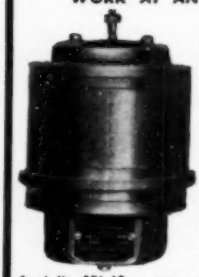
REMOTE POWER CONTROLS

WORK AT ANY DISTANCE—TO TURN



- ★ Dampers, Vents, Valves
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When shaft of one unit is turned, other will follow precisely to the same position. Develops $2\frac{1}{2}$ lb. in. of torque. Simple electrical connections. $4\frac{1}{2}$" dia. x $5\frac{1}{2}$" long. Solid bronze corrosion proof housing. Operates on 115 V 60 cy AC. Complete instructions.

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Motor complete with transformer for 115 v 60 cy operation (Stock No. AMO64) $2.95

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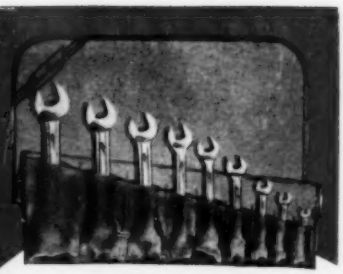
Blue-Point Supreme

Open End Wrenches

are unequaled for strength, toughness and fatigue-resistance

Here are the eight superior qualities that make them the finest tools money can buy: 1. Thinner heads. 2. Narrower jaws. 3. Precision machined openings. 4. Greater strength. 5. Lighter weight. 6. Balanced design. 7. Sure-grip handle. 8. Finest alloy high carbon steel, heat treated from skin to core.



Blue-Point Supreme 9-Pc. Wrench Set

$16.15 In Kit Bag

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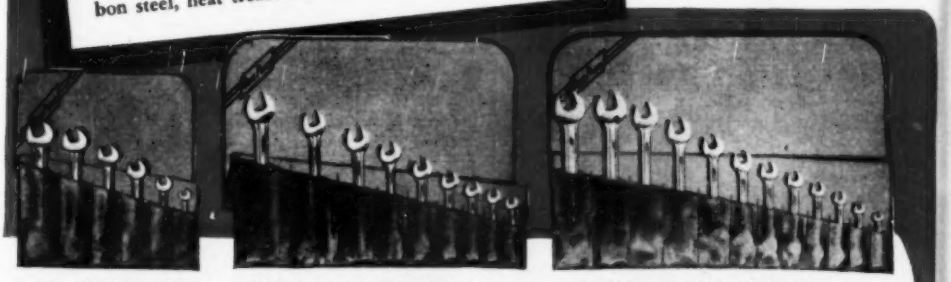
Here is one of Snap-on's most popular Open End Wrench Kits. There are 18 different wrench sizes that range from 1/4" to 1 1/4". They solve many of your nut-turning problems.



6-PC. WRENCH SET

12 popular wrench sizes on six handles. Sizes from 3/8" to 15/16". No duplication of sizes. In leatherette kit bag . . **$8.50**

Tools only . . . **$7.70**

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THE CHOICE OF BETTER MECHANICS

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7 SUPERIOR FEATURES: "Chrome Clad," Non-Glare Satin Finish, Easy to Read, Rust and Wear Resistant • One Piece Spindle • Hardened Ground Thread • Easy Adjustment • Cutaway Frame • "Rapid Reading" (Each Thousandth Numbered) • Micro-Lapped Mirror-Like Finish on Anvil and Spindle Ends.

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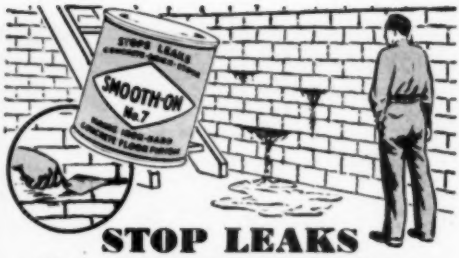

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- **And ALL these *selected* accessories!**

Choice of three kits, each with just the right equipment you need for your particular jobs. These kits assure the best work and the most work from the rugged GUILD Sander-Polisher.

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Micrometer elevation and windage adjustment. Precision built. Helps build top marksmanship.

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The beautiful, durable, service-proven gunstock material—permits custom stock features and appearance on guns priced with the lowest. Now available on the Stevens model 87 (illus. at left) as well as other Stevens rifles and shotguns.

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Model 15 — .22 cal. Bolt Action, Single Shot Rifle. Chambered for .22 long rifle; .22 long or .22 short cartridges. The lowest priced lightweight "22" in the field.

Model 87 — Semi-Automatic .22 cal. Rifle. Shoots 15 shots as fast as trigger can be pulled. Also, instantly adjustable as single shot or bolt action repeater, shooting .22 long rifle; .22 long or .22 short cartridges.

Stevens Models 86S - 84S - 87S; same as above with No. 150 Micro Peep Sight with Hooded Front Sight illustrated above.

SAVAGE .22 Rifles—First in quality

Model 6 — .22 cal. Auto-Loading Rifle — shoots fifteen long rifle cartridges as fast as you can pull the trigger. Also, instantly adjustable as bolt action repeater; shooting .22 long rifle; .22 long or .22 short cartridges.

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Model 4 — .22 cal. Bolt Action 5-shot Clip Magazine Rifle. Chambered for .22 long rifle; .22 long or .22 short cartridges. Stock and forestock of walnut.

Model 3 — .22 cal. Single Shot Bolt Action Rifle. Shoots .22 long rifle; .22 long or .22 short cartridges, regular or high speed. Positive safety. Walnut stock and forestock.

Savage Models 6S - 5S - 4S - 3S; same with No. 150 Micro Peep Sight with Hooded Front Sight illustrated and described above.

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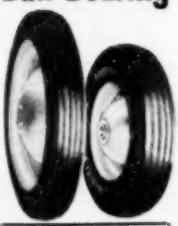

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(Semi-pneumatic tire, ball bearing)

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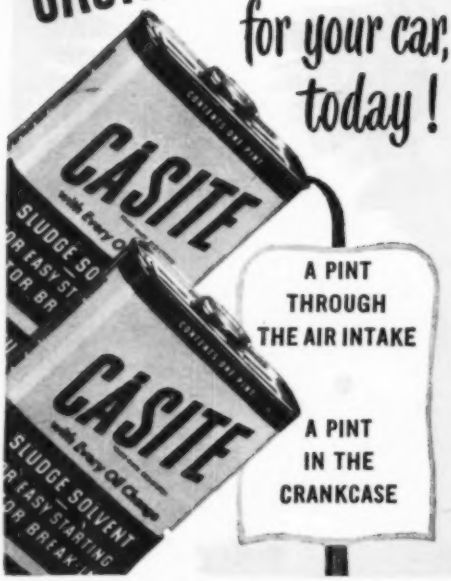

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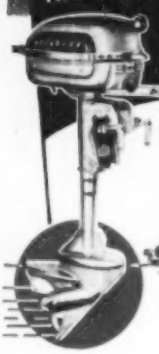

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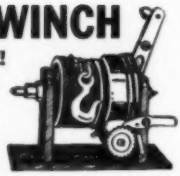

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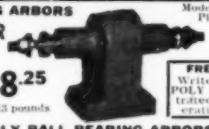

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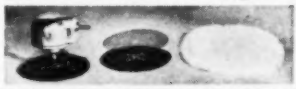

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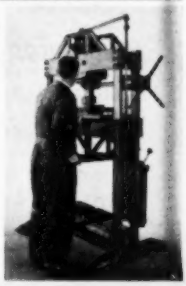

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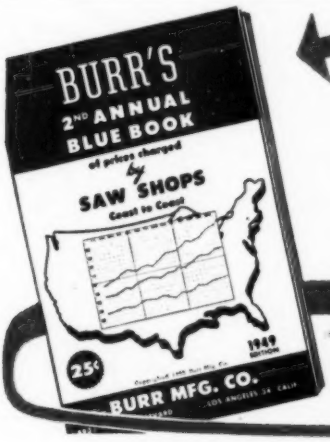

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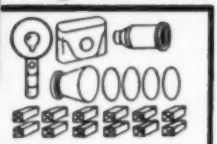

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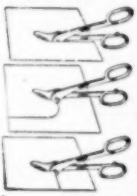

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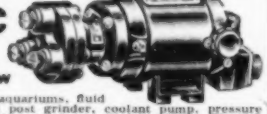

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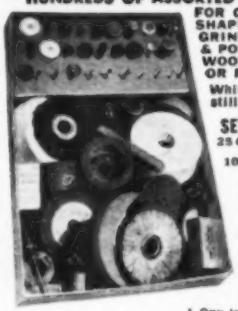

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1 ⅞" rubber wheel on ⅛" mandrel
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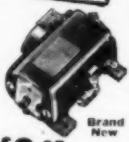

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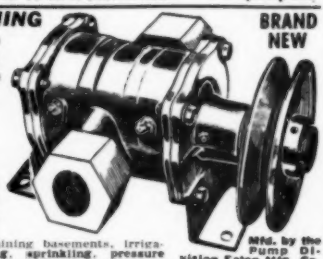

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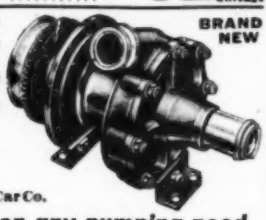

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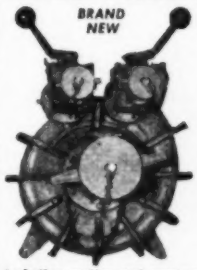

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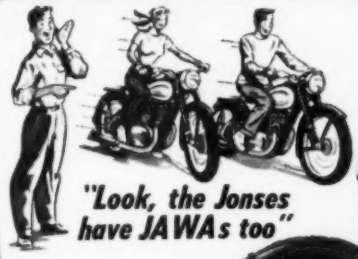

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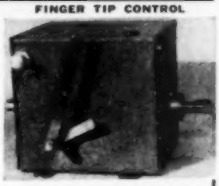

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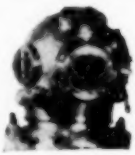

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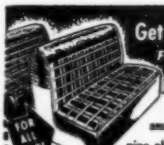

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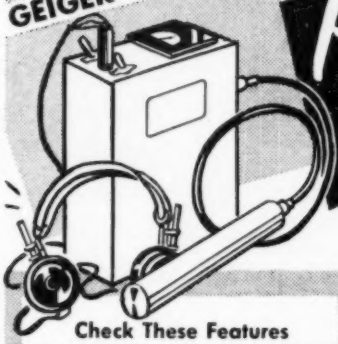

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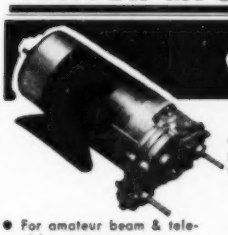

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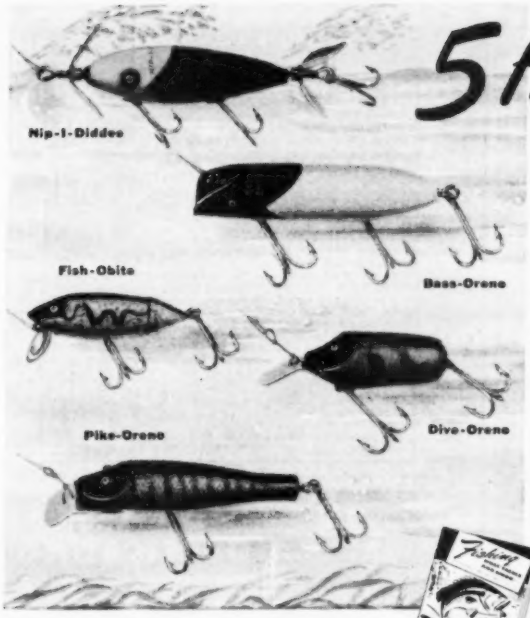

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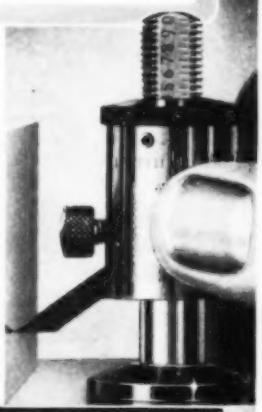

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WORKS ON IRON, STEEL & other metals . . . does work you'd expect from a larger, costlier machine; portable, easily carried; **OPERATES FROM ANY** properly wired **110 VOLT LINE.** Also available for 220 volt operation at slight additional cost; has 8 metalic & carbon arc welding heat stages. **EASY TO OPERATE TRANSFORMER TYPE WELDER**—If inexperienced you can learn to do professional work by following the **SIMPLIFIED WELDING & OPERATING INSTRUCTIONS FURNISHED**—comes complete ready to operate with helmet, rods, cable, instructions. **SAVE TIME AND MONEY**—Do your own welding—Just a few repair jobs will pay for this machine. A practical and profitable machine tool for any workshop. Make money doing repair work for others. Costs a few cents to operate.

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DIE-LESS DUPLICATING
with DI-ACRO SHEAR

Many small parts can be rapidly duplicated without dies, to accuracy of .001" with DI-ACRO "Die-Less Duplicating" Machines,—Benders, Brakes, Shears, Rod Partners, Notchers, Punches. Save die expense and time delay. For experimental work, samples, models, etc., as well as regular production runs. Write for "Die-Less Duplicating" circular.

O'NEIL-IRWIN MFG. CO., 342 8th Ave., Lake City, Minn.

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LOCK-STITCH SEWING AWL

$1. Postpaid

Famous, patented lock-stitch sewing awl complete with needles, waxed thread and direction folder. Hundred uses — sewing, repairing leather goods, canvas, belting, harness, saddles, gun cases, awnings, golf bags. Extra needles and thread available. Satisfaction guaranteed or money back. Send currency, check or money order.

Yates Mfg. Co., 611-K Main St., Lake Geneva, Wisconsin

BUILD YOUR OWN TILTING ARBOR SAW!
SAVE $50 OR MORE

27x28 in. table stays level. Blade tilts full 45 degrees.
10 in. blade cuts 3¼ in. deep. Jackscrew depth adjustment.
Floor model, 34 in. table height.
New Departure ball bearing arbor, ¾ in. precision shaft, ready to run, ⅝ in. bore blades.
Quick-positioning, self-aligning rip fence guide. Sturdy wood, steel and aluminum construction. No machining—Build easily with hand tools only.
Capacity and performance of floor saws selling for $150.00 and up!!
GIL-BILT Step-by-Step pictorial plans (No blueprint reading required), full scale patterns, actual photographs **$1.00**

GIL-BILT Metal Parts Kit—includes Plans, ball bearing arbor, cast aluminum miter gauge and bar, rip fence guide, machined lock knobs, jackscrew mechanism with 4½ in. handwheel, and all other metal parts (less blade) **$20.95**
Same Kit with 10" combination blade **$25.90**
Same Kit with 8" combination blade **$24.90**

(Prices include postage up to 600 miles.
Plans sent postpaid anywhere in the world)

Also available—Plans and Metal Parts Kits for 8" Tilt/Table Saw and 12" Band Saw. Order Plans at $1.00 each, or write for **Free** descriptive Catalog.

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plus pressure tank, pop valve, gauge for tank, air regulator & gauge, filter, 20 ft. air hose, check valve & air chuck

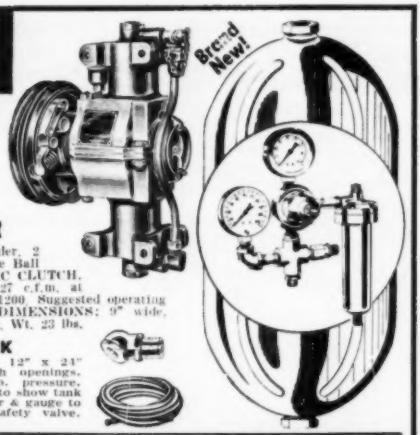
10 ITEMS ALL For $37.50

IDEAL FOR HOME • FARM • FACTORY

Wherever compressed air is needed

A fortunate purchase from the government enables us to offer you this amazing buy at a small fraction of its original cost. All brand new. You get the WESTINGHOUSE COMPRESSOR and all of the accessories shown **for only $37.50.** Shipping wt. 50 lbs. Designed for automotive truck or tractor mounting. Can be run off fan belt or power take-off, or mounted horizontally. Comes with automatic clutch. Can be installed for use on farm trucks, jeeps, tractors, tire or garage service trucks, contractor or road building machinery, pneumatic devices, etc. Can be operated with 1-H.P. or more electric motor or equivalent portable gas engine. Replacement parts available.

Compressor separately $21.50
Equipment less compressor, $18.50



THE COMPRESSOR

Piston Type, 2-cylinder, 2 inch bore, 1½" Stroke Ball Bearing, AUTOMATIC CLUTCH, OIL FREE AIR, 3.27 c.f.m. at 600 R.P.M. 6.54 at 1200. Suggested operating pressure 75 P.S.I. DIMENSIONS: 9" wide, 11⅞" high, 6⅝" deep. Wt. 23 lbs.

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Stainless steel, size 12" x 24" with 2 quarter inch openings. Suitable for 150 lb. pressure. Equipped with gauge to show tank pressure, air regulator & gauge to regulate pressure, safety valve, oil and water trap.

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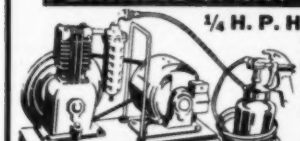


¼ H. P. HEAVY DUTY

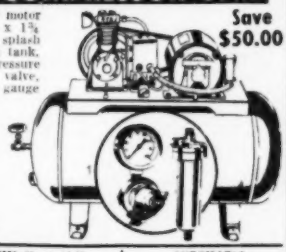
Compressor only . . $17.50
Compressor and filter . . $19.50
Spray gun and hose . . $10.45
Adj. ½" pop valve . . . $1.50
2½" Air gauge . . $1.75

well balanced Portable Spray Painting Outfit for use where painting job requires a larger quantity of material. Sprays all types of average viscosity paints, enamels, lacquers, varnishes, etc. Piston type, single cylinder air compressor has 2 in. bore by 1¾ in. stroke. Displacement 2.86 C.F.M.; maximum working pressure 40 lbs. Mounted on sturdy wood base with rubber feet attached. Pulsation chamber is equipped with safety valve, drain cock, ¼ H.P. motor, 110-volt AC, with cord and plug; 20 ft. air hose and fittings. Spray Gun is pressure feed type, internal atomizing, with one quart metal cup. Fan and round spray nozzle furnished. Shipping Wt. 50 lbs. **$45.00**

AUTOMATIC COMPRESSOR UNIT

1/3 H.P. heavy duty capacitor motor AC 110/220 volt 60 cycle, 2 x 1¾ inch piston type compressor, splash feed lubrication, 12 x 24 inch tank, automatic pressure switch, pressure range 100 to 125 lbs., check valve, safety valve, air regulator with gauge and filter, 20 ft. air hose with air chuck for inflating tires, V. belt drive. Shipping wt. 90 lbs.

Save $50.00



Special Price $79.50

Same unit as above with ½ H.P. motor, furnished with 13" x 24" tank. Shipping wt. 125 lbs. $98.50

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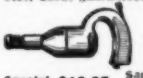
Riveting and chipping hammers for many uses: riveting, chipping, hammering, auto body work, concrete breaking, etc.; used, guaranteed like new.

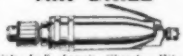
Chicago Pneumatic Riveter & Chipping Hammer



CP4X Pistol grip handle with air control. Takes up to 3/16" rivet. Weight 6 lbs. List price $73.00.

Special Price $12.95 — **Same, as above, brand new $19.50** — **Size CP3—Takes 5/32" Rivet $8.95**

Chicago Pneumatic Lever Type AIR DRILL



With ¼" Jacob Chuck. Wt. 2 lbs. List price $55.00. only . . **$15.00**

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Price f.o.b. Chicago. Immediate delivery. All items sold on money back guarantee. Send check or money order today. Write for free catalog.

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Push button, takes 5/32" rivet. Wt. 3 lbs. List price $65.00. Only **$8.95**

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Takes ⅛" rivet. Wt. 3 lbs. List price $80. Only **$8.95**
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Dash Pot. Quiet Operating.

¼"	$2.75
⅜"	3.25
½"	4.50
¾"	9.50
1"	12.50

AUTOMATIC PRESSURE SWITCH WITH UNLOADER

Double pole, with 2 way release valve. Set at 125 to 150 lbs. pressure. Weight 4 lbs. ONLY **$10.25**

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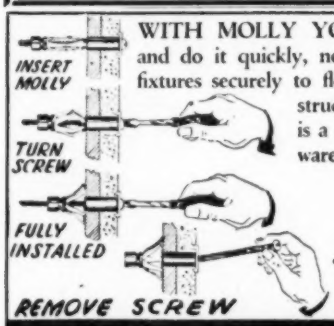
1831 S. STATE ST., DEPT. B-5, CHICAGO 16, ILL.



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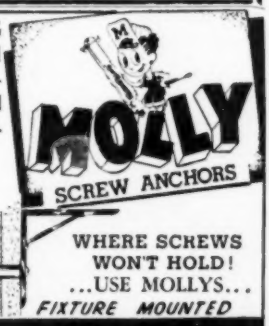

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Modern—streamlined—fits the hand like a fountain pen! Easy to use as a pencil. Draws parallel lines—straight, curve or circular. Does expert job on autos, furniture, toys, bikes, model planes, signs, bulletins, linoleum. (Makes wall board look like tile.) Every painter and craftsman needs one! Type "M" MASTER Painters' Striping Tool complete with tip for 1/16" stripe, $1.00. Tool with choice of 1/64", 1/32", 3/64", 5/64", 3/32", 1/8" tip—$1.50 . . . all tips 75c ea. Tool with complete set of 7 tips $5.00. (COD's postage collect) Paint dealers, write!

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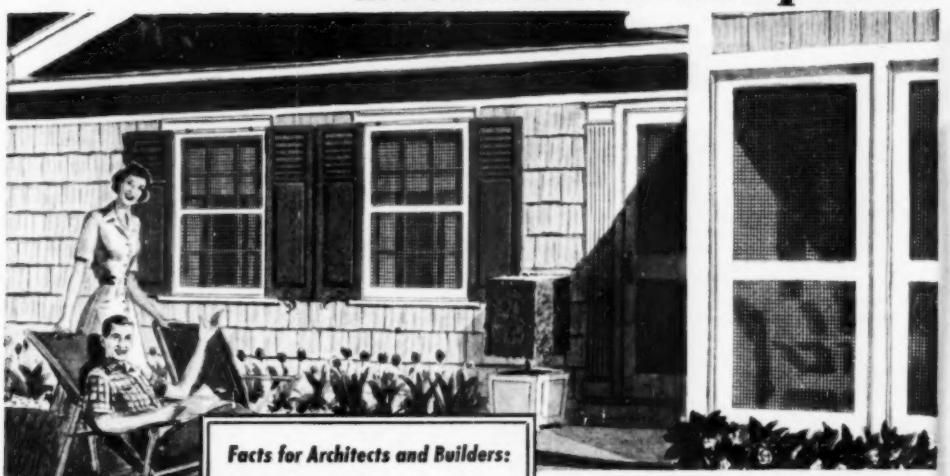
STAINPROOF

Because it's Rustproof!



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CAN'T STAIN YOUR HOUSE!

CAN'T RUST OR CORRODE

Facts for Architects and Builders:

Effect of acids, alkalis and solvents—Essentially none.

Effect of age—Independent scientific tests indicate that LUMITE is more durable than any other type of screen cloth under all climatic conditions that might normally be encountered.

Non-inflammable—Will not support flame . . . is self-extinguishing. Melting point, 340°F.

Tensile strength—Up to 40,000 lbs. per square inch.

Impact strength—Greater than conventional screening.

Installation—Cut with ordinary scissors. Fold cut edges under one-half inch. Tack or staple the screening smoothly and evenly every 1½". Because of inherent characteristics LUMITE will gradually draw itself into a snug, firm fit. For correct methods of machine framing, consult LUMITE engineers.

Imagine a screening that can be GUARANTEED never to rust, rot, corrode or stain your house—yet costs only 11½-12¢ per square foot. That's LUMITE!

Imagine a plastic so strong that it actually has greater impact strength than any other type of screening. That's LUMITE!

Imagine a screening that never needs painting to protect it from rust or corrosion. That's LUMITE!

Imagine a screening that is so easy to handle anyone can frame it—no special tools needed—will never sag or bulge when properly framed. That's LUMITE!

For your new home or to replace old screens, order LUMITE from your hardware, lumber or building supply dealer.

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INSIST ON RUSTPROOF SCREENING

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woven saran screening

THIS AMAZING, NEW, LOW-PRICED OSCILLATING, SANDER AND POLISHER!

$14.95 DU-FAST ATTACHMENT* ONLY

CRAFTSMEN! Here's the new, versatile, OSCILLATING Sander and Polisher . . . the perfect attachment for every HOME UTILITY ¼" Electric Drill and HOME UTILITY 5" Disc Sander-Polisher.

Now, in a fraction of the time, and with far less "elbow grease", the DU-FAST SANDER AND POLISHER* gives you certain, superior finishes every time . . . plus a definite saving in time and money!

- ATTACHED AND DETACHED IN A JIFFY
- WEIGHS ONLY 5 LBS. (with drill) – ELIMINATES FATIGUE
- EASY TO USE IN CORNERS, ON OPEN STOCK, AND ON CURVED SURFACES

If you use a B & D Home Utility ¼" drill . . . you'll want the Du-Fast Oscillating Sander and Polisher attachment. In any case, don't fail to see it and try it at any hardware dealer who carries B & D Home Utility Tools.

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Available only at hardware dealers carrying Black & Decker Home Utility Tools. Stop at one today!

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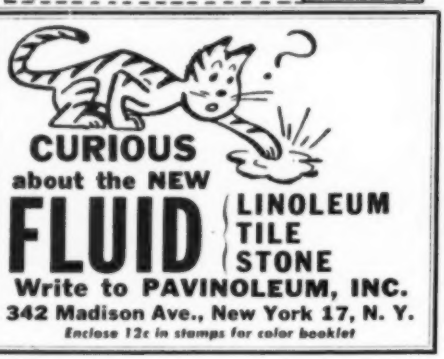
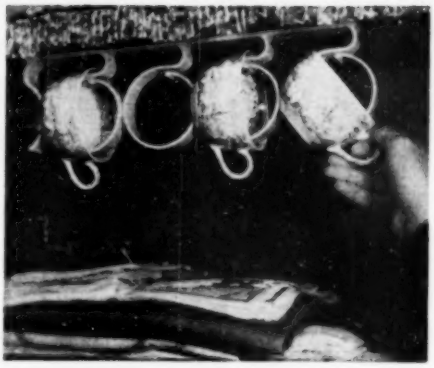
MAKE METAL PROJECTS with CHROMTRIM



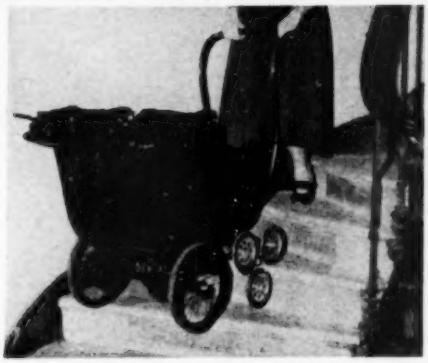
Aids to



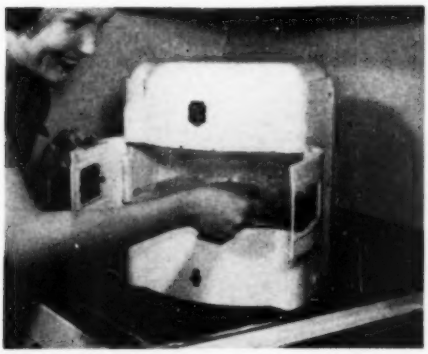
Cups Clipped in Rack. Each of these plastic racks holds four cups and can be installed at any angle under a shelf, on a cupboard door, wall, or in a drawer. To insert cups, roll them over and around the circle until the base of the cup clips into place. The maker, Leipzig and Lippe, Inc., New York City, prices the racks at $1.

Nuteracker Is Pistol Shaped. While this cracker handles all kinds of nuts, it is mainly designed for pecans, permitting the meat to be extracted whole. Pulling the trigger moves the front cracking cup forward. The nut is inserted and the handles squeezed to crack it. The device is made of aluminum die castings by the John W. Clark Industries, of San Marcos, Tex. It retails for about $4.

Modern Living



Baby Carriage Climbs Stairs. Almost every mother knows the difficulty of getting a baby carriage up and down stairs and curbs. This carriage, a new British product, licks the problem with the six small wheels—three on each side—at the rear. Each of the small wheels revolves on its own axle and each set turns on a common axle.



Infrared Rays Cook Food. Another push-button kitchen aid is this cooker that fries, broils, or bakes with heat from two infrared lamps. Two lamps, one above and the other below, are focused on a transparent food tray. In photo, piece of meat wrapped in plastic is being placed on the tray. Steaks can be prepared in from one and a half to six minutes. The Dorby Co., Chicago, prices it about $42.

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$1.49 3 for $4.35

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for utility painting of tables—chairs—screens—floors—clothes hampers—car fenders—toys

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Just think, 32 or 64 drawer cabinet to keep those small items that usually get mislaid. Spot welded steel cabinet, enamel finish, metal drawer guides. Looks good anywhere. Send check or money order please—no C.O.D.'s. Prices below. Your money refunded if not satisfied.

SPECIFICATIONS	WITH ALUMINUM DRAWERS	WITH CARDBOARD DRAWERS
32 Drawer Unit 6" Deep 12⅝" Wide 18¼" High **64 Drawer Unit** 6" Deep 25½" Wide 18¼" High **Drawer Size** 1¼" Deep 2¾" Wide 6" Long	One piece rustproof aluminum drawers for heavy service—good for work bench and industry use.	Suitable for most home uses. Heavy board kraft covered. Metal drawer pulls.
	32 drw. $8.95	**32 drw. $5.95**
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	POSTAGE PAID	POSTAGE PAID

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Now I remove paint the EASY WAY!

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WASH YOUR WINDOWS THIS SAFEWAY
USE THE
SAFETY WINDOW SEAT

SEND FOR ONE TODAY

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Agents Wanted

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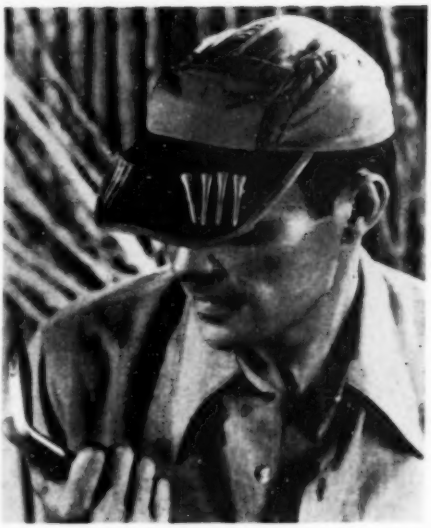
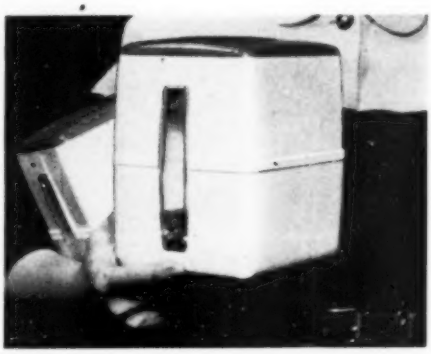
Aids to Modern Living

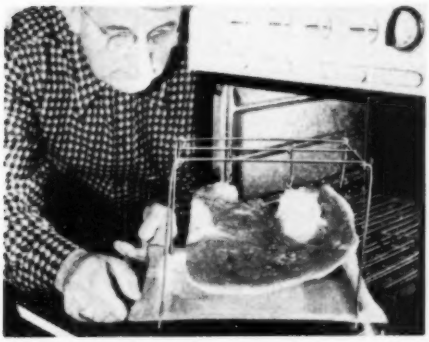


Sports Cap Has Zipper Pocket. A zipper pocket and loops on the visor for golf tees or fishing flies are features of this sports cap made by Westbrook Hats, Inc., New York City. The Vinylite® visor is forest green and is also available without the loops. On the beach, the cap pocket can be used to carry a watch, cash, a few cigarettes and matches, or a bath-locker key. Price is about $2.50.



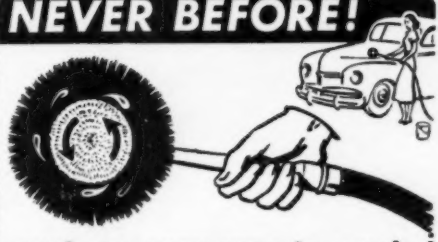
Windowed Canisters. A glance at these canisters tells a housewife how much sugar, rice, flour, or dried food she has on hand. The all-plastic containers are made by Canistor, Inc., of Racine, Wis.

Ironing Board Is Adjustable. The Met-L-Top® ironing table has seven height adjustments from 31½" to 35½" to suit women of different heights. Other features include a white enameled top that is perforated, allowing steam to pass through it. Each of the legs has a telescoping section held by a thumbscrew. Legs are marked for equal adjustment. It's priced about $11 by Geuder, Paeschke & Frey Co., Milwaukee.



Cooker Retains Moisture. Two hooks on the rack hold meat, poultry, or fish off the pan to cook while retaining their moisture and vitamin content, according to the inventor, R. F. Tibbetts, Los Angeles.

NEVER BEFORE!



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- Free! Special washing detergent.

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Write for color chart.

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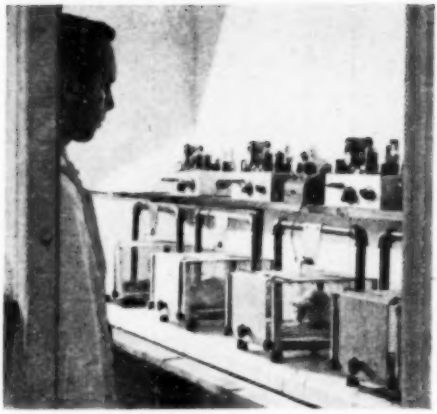
TO: Reader
FROM: Editor

Prescribe TV For Your M.D.



Four rats watched by 1,000 doctors.

PS EDITORS disregard many predictions—often they cannot be proved true or false for a long time—but pass on to you those that seem most plausible and interesting. In February, 1947, we reported Dr. Vladimir K. Zworykin's prophecy that television might change one's whole concept of educational techniques, especially in medicine. We thought then of the need for more doctors and hoped it might make larger classes possible in the medical schools. That seems less likely now, but TV has turned out to be an extremely valuable means of keeping doctors up to date after they leave school.

With nearly 1,000 doctors, I looked over the shoulder of Dr. Edwin J. Fellows this spring while he demonstrated the effects of some new drugs in the Smith, Kline & French laboratories in Philadelphia. Only a few men could have crowded around Dr. Fellows' animals and apparatus, but three television screens—each one as big as a bedsheet—enabled an auditorium full of doctors to study his work.

First he injected a chemical compound intended to relieve nasal congestion into an anesthetized cat. The cat's reactions showed its systemic, or over-all, effects. Then he permitted an anesthetized dog to breathe the stuff, and measured the changes within the dog's nose electrically by means of two electrodes taped to the dog's head.

To show a drug's effects on activity, Dr. Fellows used four rats. He placed each one in a cage mounted on sponge rubber and so arranged that every little movement of the rat increased the charge in an electrical condenser. The condensers then guided four pencils that recorded the rats' friskiness.

A third experiment was performed with two rabbits. Each was suspended in a cradle and given an electric shock. One rabbit's convulsion lasted longer and was followed by more rigidity than that of the other rabbit. The latter had been given a drug that may help victims of epilepsy.

One of the physicians fascinated by the TV view of this research told me afterwards that he had learned more by "making the rounds" of patients in a hospital with a professor than in any other way. He then pointed out that a TV camera also can follow a great doctor on his rounds and show many other doctors what he does. This, too, has been done.

Next month, 12,000 doctors at the American Medical Association meeting in Atlantic City will be shown TV close-ups of the hands of University of Pennsylvania surgeons at work in their operating rooms. Color television is to be used then.

Dr. Morris Fishbein of the AMA calls the electric light the greatest invention in medicine because it enables doctors to see into the body's openings. By also helping them peer into the laboratories of pharmaceutical pioneers, the clinics of specialists, and the incisions of successful surgeons, TV is now showing the doctors what it's best to do about the troubles they discover with their many little electric lights.

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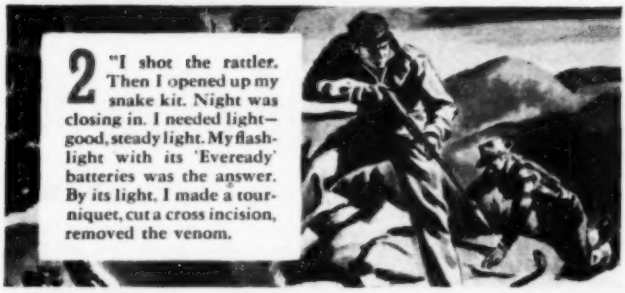
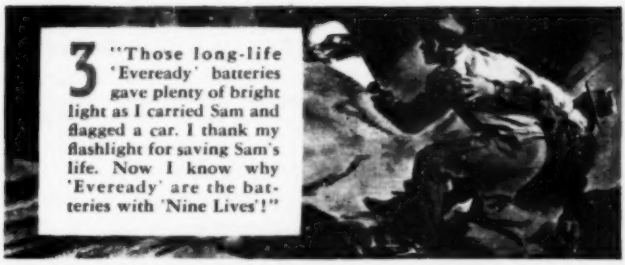
A reprint of an interesting national magazine article on Pad-O'-Paint is yours for the asking. Write The Arco Company, 7301 Bessemer Avenue, Cleveland 4, Ohio.

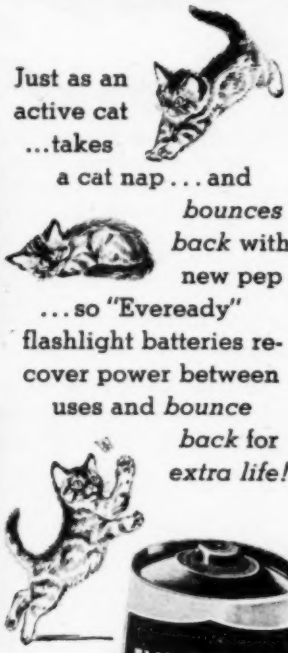
1 "A piercing shriek cut the silence as I lay in wait for deer in the Laguna Mountains near San Diego. I dashed to Sam Reardon, my hunting companion. A 3½-foot rattler had dug his fangs into Sam's ankle! Twice in my own life, I'd felt the rattler's sting. I knew what to do.



2 "I shot the rattler. Then I opened up my snake kit. Night was closing in. I needed light—good, steady light. My flashlight with its 'Eveready' batteries was the answer. By its light, I made a tourniquet, cut a cross incision, removed the venom.



3 "Those long-life 'Eveready' batteries gave plenty of bright light as I carried Sam and flagged a car. I thank my flashlight for saving Sam's life. Now I know why 'Eveready' are the batteries with 'Nine Lives'!"



Just as an active cat ...takes a cat nap ... and *bounces back* with new pep ... so "Eveready" flashlight batteries recover power between uses and *bounce back* for *extra life!*

THE FLASHLIGHT BATTERY WITH "NINE LIVES"!

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SAVE MONEY, TIME, WORK! GET PROFESSIONAL RESULTS!

- **Paint Floors, Ceilings, Walls, Woodwork, Furniture, Toys**
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- **Varnish Table Tops, Linoleum**
- **Spray Moth-Proofing Liquids in Closets and Attics**
- **Spray Flit or Other Insect and Pest Solutions**
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- **USE VIBRO SPRAYER for EVERY Job of Painting and Spraying in and Around the Home**
- **Self-Contained Unit—No Motor, No Compressor, Produces Equivalent of 30 lbs. Pressure!**

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Yes, now you can do a *professional painting* job on everything in and around your house with this amazing, brand new, self-contained electric paint sprayer. Just fill the big, 25-ounce capacity, interchangeable mason jar with any kind of ordinary oilbase liquid—lacquer, glossy paint, enamel, varnish, shellac, residual type insecticides, light oils, moth sprays, disinfectants, etc. Then plug the 8-ft. insulated cord into any 110-volt A.C. household outlet—pull the trigger—and get satin-smooth, professional results *every time!*

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VIBRO-SPRAYER paints twice as fast as a brush, saves strain, fatigue, backache and sore muscles. Paint goes on FASTER, SMOOTHER and far more EASILY than with a brush. Adjustable spray control allows wide or narrow spray, thick or fine, as the job requires. Spray radius is always under complete control. VIBRO-SPRAYER cannot clog or drip—and is amazingly simple to clean. What's more, VIBRO-SPRAYER is SAFE! Will never break in use as there is NO pressure in the jar.

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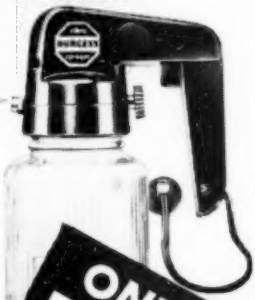

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